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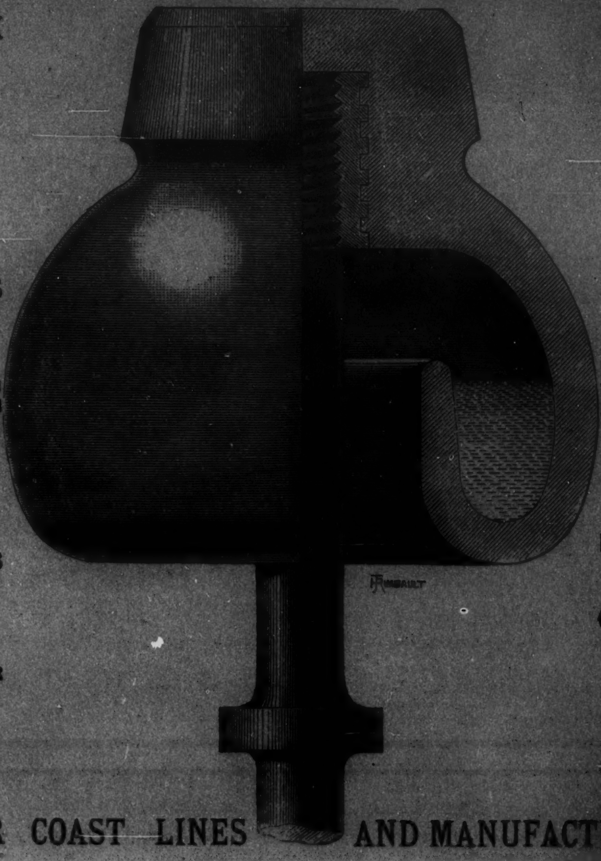

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THE TELEGRAPHIC JOURNAL AND
Electrical Review.
Vol. XVI.—No. 375.

DYNAMO TESTING.

We feel assured that those of our readers who are intimately connected with, or in any way interested in, the construction and running of dynamo-electric machinery have closely studied the performance of the Edison-Hopkinson machine as reported in our last issue.

It may be asked, what was the object of those gentlemen who formulated the experiments to which we now refer? Certainly not to gain, so far as we can see, any information as to the efficiency of this dynamo, but rather, we imagine, in imitation of the recently "invented" long-distance pedestrian contests, as a "test of endurance." Although the long distances which our pedestrians voluntarily traverse for a small pecuniary reward and as an endurance test, are never likely to obtain in the ordinary course of one's life, it cannot be said that a continuous run for a fortnight is a useless test for a dynamo machine to undergo, especially when the inventors of the apparatus subjected to such an ordeal do not look kindly upon electric lighting carried out by the supplementary assistance of secondary batteries, but prefer to depend for satisfactory results upon a good machine alone.

Under such circumstances, therefore, the test is doubtless one of a most useful character, and calculated to give a certain amount of confidence to those who believe that accumulators are not absolutely essential for the purpose of keeping up a permanent supply of electrical energy.

It showed also that the machine was well constructed, from a mechanical engineering point of view, especially in its running parts, and that the insulation was good and permanent, and not affected by the maximum temperature to which the armature is said to have risen. With respect to this matter of heating we doubt very much whether implicit confidence can be placed in some of the figures given. We are inclined to the belief that the measured temperature did not by any means represent the heat in the interior of the armature. As an instance of this we will only remark that we have on several occasions found in sections of the wire on Gramme rings that the convolutions nearest the iron core had been completely denuded of insulation by the heat there developed charring the silk or cotton, whilst those convolutions on the periphery of the ring remained, to all appearance, unchanged. It is almost certain that had the temperature of the armature been observed some half-an-hour or so after stopping from a lengthened run the heat would have indicated a higher reading. Be this as it may, however, it does not alter the fact that the Edison-Hopkinson machine was unaffected by whatever heat was developed.

That the machine was run with a load 10 per cent. above that of its normal capacity scarcely needs comment, as machinery of all kinds is usually constructed to withstand something more than is expected in general operation.

We are not aware of any similar instance, at all events in this country, of a dynamo machine being so severely tried and not found wanting. Perhaps a still more satisfactory test would have been to run continuously for, say, the same number of days with a widely varying load, which would have taxed the capabilities of the machine still further, and which, indeed, would represent what would be more likely to happen in actual practice. The dynamo would then necessarily have been subjected to varying strains and temperatures, and this, we imagine, is far more calculated to show up any incipient defects which might otherwise remain undeveloped.

A SHORT HISTORY OF INCANDESCENCE LAMPS.

By A. GELYI.

For years (that is to say, ever since the electric light, advancing with great strides towards perfection, gained for itself a well-deserved place amongst the various technical applications), it has been a moot question whether it is intended to supersede the existing sources of artificial light, especially the gas-light, the use of which became universal in such a short time; and whether it must be regarded as the sole means of illumination of the future. For a long time this question appeared to be answered, in certain circles, in a manner unfavourable to the electric light; as one of the many objections to the electric light, it was pointed out that it—the general public understood by that term the arc light, which was at that time exclusively used—suffered, as it were, from an *embarras de richesse*, as the flood of light which issued from the electric lamps was, in consequence of its great intensity, only fit for the illumination of vast spaces, whilst the gas still appeared to be the source of light most suitable for general and domestic purposes.

It is true that the electric arc light may be considered capable of a division at least approximately adequate to the demands of practical generalisation, as it is at present possible to divide the current over lamps with intensities varying from 20 to 10 gas flames. But, on the one hand, that minimum of intensity is in many cases, especially for domestic purposes, a great deal too high; whilst, on the other hand, the regulating mechanism is so expensive that, in this case at least, the electric light cannot compete with the gas-light as regards cheapness. It is evident that, under those circumstances, it would be of the utmost importance to possess a lamp which could produce, without the aid of regulating mechanism, an electric light of far less intensity, say of a minimum intensity of one gas flame.

But the labourers in this field had to encounter numerous errors and disappointments, until they at last succeeded in hitting upon the correct and practical thing. The history of the glow lamp may also properly be considered as the history of the errors made in the field of electro-technical research. Notwithstanding the scientific earnestness which animated the labourers in that field, it makes often a really comical impression on us when we, studying with attention the history of the development of the glow lamp, represent to ourselves the frantic exertions of some inventors, who were in many cases powerfully supported by speculating capitalists, and when we observe how many an inventor allows the decisive moment to approach in the belief of having reached at last the ideal of his wishes, in order to awake at the next moment from his dream, and see before him, instead of the longed-for glow light globe, a deceitfully twinkling soap bubble, which at the first touch is shattered into milliards of atoms, and leaves the disheartened inventor nothing but bitter disappointment.

The great problem to be solved was to invent an electric conductor which in a vacuum would neither burn away nor be vapourised; and now succeeded a burrowing and hunting after the treasures which lie concealed in the deep shafts of science, to bring forth which each enthusiastic student of the natural sciences felt himself called. It was at first principally American capital which supplied the funds necessary for the pursuit of an idea, from the realisation of which golden fruits were justly anticipated.

Bearing in mind that all roads lead to Rome, inventors attempted to reach the goal in the most various ways, and by the most different means, until at last the conviction dawned upon them that there are only two substances in existence which possess, in a sufficiently high degree, such properties as are indispensable for the production of the glow light, namely, platinum or an alloy of platinum and iridium, and secondly, carbon.

Platinum has this advantage over carbon, that it, even when heated to whiteness, does not consume away in the air, a property which caused that metal to be regarded as particularly suitable for glow light purposes: but in another not less important respect that metal is far behind carbon, that is to say, that it is by no means capable of sustaining such a high degree of heat without fusing. It is evident that when light is to be produced by means of glow lamps the conducting material must possess the capacity of resisting an exceedingly high degree of heat.

This circumstance, especially when considered from an economical point of view, has a very high importance, as the quantity of light emitted by a glowing substance rises in a more rapid proportion than the temperature of that substance. When we, for instance, heat to redness a piece of platinum wire or of carbon filament, very little or no light is emitted; but if we double the degree of temperature by passing a current of double strength through the conductor, we shall obtain more than double the quantity of light. It cannot, therefore, be disputed that the higher the degree of heat to which we raise the glowing material, the less will be the cost of the energy expended on the light.

Carbon or Metal?—This was now the great question which occupied for decades every thinking electrician, and which the most able representatives of electrotechnics set themselves the task of solving. It will not at all be uninteresting to describe the history of this movement which has become so important, and during whose course visions of success, which created more or less justifiable sensation, comet-like appeared and vanished.

We will now give a concise account of the most important phases of the above-mentioned movement, and only dwell longer on the labours of such prominent workers as De Changy, King, Starr, Edison, and Swan, whose experiments and their results we purpose to consider more minutely.

It was Professor Jobard, of Brussels, who gave the first impulse to the highly important experiments with glow lamps. This *savant* suggested, in the year 1838, in the *Courrier Libéral, that a small strip of carbon in a vacuum used as conductor of a current,* would emit an intense, fixed, and durable light. Prof. Jobard then advised his former pupil, De Changy, to attempt the practical realisation of his idea. De Changy was the more ready to enter upon the necessary experiments as he, in his capacity of mining engineer, considered he would be able to open up a wide field for glow light illumination in the shafts and galleries of mines.

After some preparatory theoretical study De Changy commenced his labours in the year 1844, after an Englishman, of the name of Moleyns, had, as early as 1841, made the first experiments with platinum glow light lamps. De Changy made use of gas carbon cut into thin strips, which he enclosed in an exhausted glass and connected with the conducting wires. In order to impart more consistency to the carbon strips he attempted to fill up their pores by soaking them in melted rosin or in sugared solutions. The result attained was relatively favourable, and *De Changy proceeded to the construction of the first carbon glow lamp.* This was, however, the first link of that chain of experiments which runs like a red thread through the history of the development of the glow lamp. The experiments failed, on the one hand, by the carbon strips becoming disintegrated by the current, and, on the other hand, because the electric energy required for the production of the light was too great, and the degree of heat generated in the carbons too intense. The lamp was also imperfectly sealed and the vacuum insufficient, in consequence of which circumstances the carbon partially consumed away in the oxygen of the air. A heavy loss of electric energy to the light effect was due to the generation of heat, and to currents of the insufficiently rarified air. However, the above-mentioned results may, from a theoretical point of view, be considered as satisfactory, as they establish the principle of the glow lamps, and demonstrate the possibility of its realisation. But it was also evident that the glow lamps, which were produced from time to time in different places, were not at all capable of being converted to practical use. Shortly after this rather encouraging experience De Changy received the appointment of engineer-in-chief to the Weal-Ocean and Weal-Ramoth mines, in consequence of which his interesting studies and experiments were interrupted for a long period.

While de Changy occupied himself in Europe with the construction of a practical glow lamp, strenuous and industrious efforts were made in the new world, almost at the same time, to realise the same idea:—J. W. Starr, of Cincinnati, a *savant* as able as modest, entered upon a thorough study of the glow light, and made experiments with platinum as well as with carbon. As Starr possessed only a very moderate income, he would scarcely have been able to bring to a satisfactory result those wearisome experiments which entailed such heavy expenses, if he had not found in Peabody a munificent Maecenas and high-minded promoter of his plans.

Peabody, whom fate had blessed with an immense fortune, was a zealous promotor of undertakings of public utility, and has earned, as founder of magnificent and richly endowed scientific institutions, a glorious name, which will be handed down from generation to generation.

He took an especial interest in the toilsome exertions of the modest American philosopher, and afforded him considerable support; and when Starr proceeded at last to the construction of his first glow lamp, Peabody supplied him with the means necessary for a journey to Europe, in order to enable him to lay his invention in a practical form before his British colleagues and the British public.

Before entering upon his journey Starr procured himself a companion in the person of a countryman of his, named King, who, as a shrewd man of business, would be able to guard the philosopher, who felt at home in his chemical laboratory only, against a premature publication of his invention, and to guide him in other respects with his experience.

Arrived in England, King's first care was to interest competent experts in Starr's ideas, and to gain over the general public by a most effective exhibition. With this view he caused a large and magnificent chandelier, with 26 branches, to be constructed; 26 electric flames were to represent symbolically the 26 States of which the North American Republic then consisted. The anticipated effect did not remain behind; a gigantic crowd gazed at the splendid and novel spectacle; and Faraday, the celebrated philosopher to whom the scientific world is indebted for the discovery of electric induction, who witnessed the interesting experiment, signified to his American brother electrician in the most flattering terms his satisfaction with the result attained.

But it was not given to Starr to enjoy the fruits of his labours. Soon after the conclusion of the above-mentioned experiment the Americans sailed for their home, with the purpose of redoubling their efforts for bringing their glow lamp to perfection. When Starr's cabin was entered on the day after his leaving England, the able electrician was found dead in his bed. The cause of his death was not ascertained, and is likely to remain for ever an unravelled mystery.

After the tragical death of Starr, King, the practical man, took forthwith possession of his inheritance, and hastened to patent Starr's invention in his own name. The patent was granted on the 4th of November, 1845, and refers to *a glowing carbon strip in a vacuum*, or to a platinum wire glowing in the air. With the death of Starr, the funds necessary for the costly experiments ceased to flow, and in a short time the promising glow lamp, which had been inaugurated with so much pomp, was consigned to oblivion. A similar fate befell the invention of the Englishmen Greener and Staite, who patented, in the year 1846, a carbon lamp. The carbon of this lamp, which bore a striking resemblance to that of King, was cleaned with nitric acid.

In one of the recent numbers of *Nature* we read the following interesting letter from Prof. Williams, a contemporary and colleague of Starr, respecting the invention of De Changy and that of Starr-King :—" In your periodical I notice a statement to the effect that a Mr. De Changy is the first electrician who, about 20 years ago, attempted to produce electric glow light in a vacuum. With reference to that statement I declare that the invention in question was made by a young American of the name of Starr, who was successful in obtaining a practical result. Another American, King, patented Starr's invention in 1845. Starr made use of a short strip of gas carbon, and formed his vacuum in the following manner : he passed a wire through the top of a barometer tube, and closed hermetically the opening by which the wire entered ; he connected the carbon strip with this wire, that strip being also, by means of a second wire, in connection with the mercury in the tube. The tube was 36 inches long, so that when it was filled with mercury and then inverted, a Torricellian vacuum was formed.

" I assisted the inventor myself in the construction of his apparatus, and in the experiments made with them ; my remuneration was to be one-eighth of the profits. After the death of Starr all his apparatus became my property. I have, more than 20 years ago, several times exhibited the original lamp in the Midland Institute at Birmingham, and also showed it in action there. I also exhibited the lamp on two occasions in the Town Hall. The light was far clearer and the carbon strips were far more durable than the thin carbon filaments of the glow lamps of the present day.

" Starr's invention was abandoned, because the generation of the necessary electricity was too expensive ; as regards effectiveness and clearness of light the lamp was a complete success."

Without wishing to detract in the least from the merits of Williams or of Starr, we believe to have proved satisfactorily by the above-mentioned authentic dates, that De Changy was occupied with the construction of glow lamps long before Starr made his invention public. But as regards the merit of having invented the glow lamp—if there can be here at all a question of invention—neither De Changy nor Starr can claim it, as the ingenious idea of Prof. Jobard gave in the year 1838 the first impulse to the practical application of the principle of the glow light.

Three years after the granting of the Greener-Staite patent, in 1849, Petrie proposed in a patent to use iridium for glow light purposes. The use of that metal had been advocated by other electricians before as well as after Petrie ; but, from an economical point of view, it could not be used, being, in consequence of its scarcity, too expensive.

Ten years after King had patented his lamp, in the year 1855, De Changy resumed his experiments and studies with redoubled zeal. He made experiments at the same time in two directions. Without altogether abandoning carbon, he occupied himself with the construction of a glow lamp, in which platinum formed the conductor, as he imagined to attain by the use of that metal a success more speedy, although less perfect, yet of sufficiently practical value. Being well aware that in order to guard the platinum wire against the risk of fusing, the strength of the electric current must strictly be kept within certain limits, he constructed a current regulator which he patented in 1858.

The lamps provided with such a current regulator would be used for various very interesting purposes, as, for instance, for the illumination of mines, submerged for fishing purposes, for illuminating anchor buoys, and, finally, as a nautical telegraph by which, with the aid of an instrument like a keyboard, signals consisting of flashes of light could be transmitted from the top of the mast of a vessel. The platinum for these lamps was submitted to a peculiar process of preparation. De Changy caused the metal to be maintained some time heated to a moderate degree of redness, and then gradually raised it to that degree of heat to which it would be required to be heated for illuminating purposes.

(*To be continued.*)

EBEL'S CABLE RELAY AND CABLE RECORDER.

THIS relay is designed to work the Morse code at a high speed on submarine cables. The essential features of the instrument are shown by figs. 1, 2, 3, and 4. Referring to these figs., *a* and *a′* represent semi-circular armatures of iron connected by a strip or piece, *b*, of non-magnetic material, so that their exterior constitutes, approximately, a circle. S, N, represent the poles of a permanent magnet, which have adjustable pole screws, *m*, *n*, the ends of the latter being arranged close to the semi-circular, or approximately semi-circular armatures, *b*, but at such a distance from them as to leave the former free to move upon their axis or pivot, *f*, between the poles referred to. From this arrangement it follows that the portions, *a*, *a′*, of the armatures will be constantly maintained in a magnetic condition by the poles of the permanent magnet, and such armatures will retain a

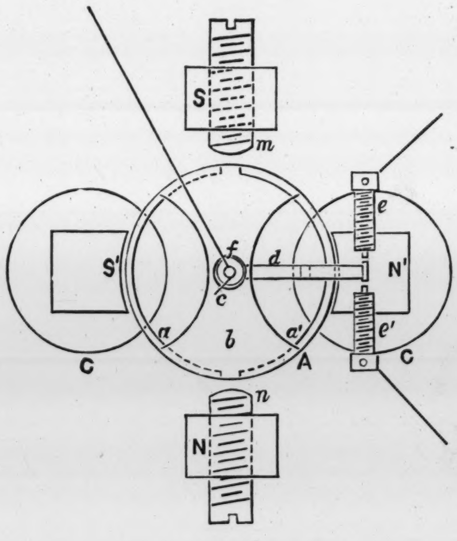


FIG. 1.

certain normal position in accordance with the direction or line of the permanent magnet. S′ and N′ represent the poles of an electro-magnet, whose surfaces adjacent to the armatures, *a*, *a′*, are arranged at such a distance from them as to permit the armatures to move freely. This electro-magnet is excited by the actuating current, and is designed to affect by influence the magnetic potential of the parts, *a*, *a′*, which will therefore, in accordance with their polarity, be caused to move in one direction or the other. *d*, is an arm secured or combined with the axis, *c*, and adapted to operate as the contact maker and breaker. *e* and *e′* represent adjustable contact stops, by which the play or movement of the arm, *d*, is regulated. The armatures, *a*, *a′*. are connected with the arm, *d*, through the medium of a yielding or flexible connection, so that such armatures can move independently of the said arm, *d*, when the latter comes in contact with either of the stops, *e* or *e′*. This yielding or flexible connection is adapted to be influenced or controlled through the medium of the friction obtainable through the spring, *g*, and adjustable nut, *f*.

FIG. 2.

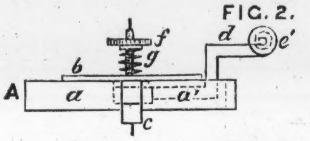


FIG. 3.

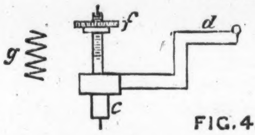
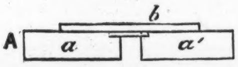


FIG. 4.



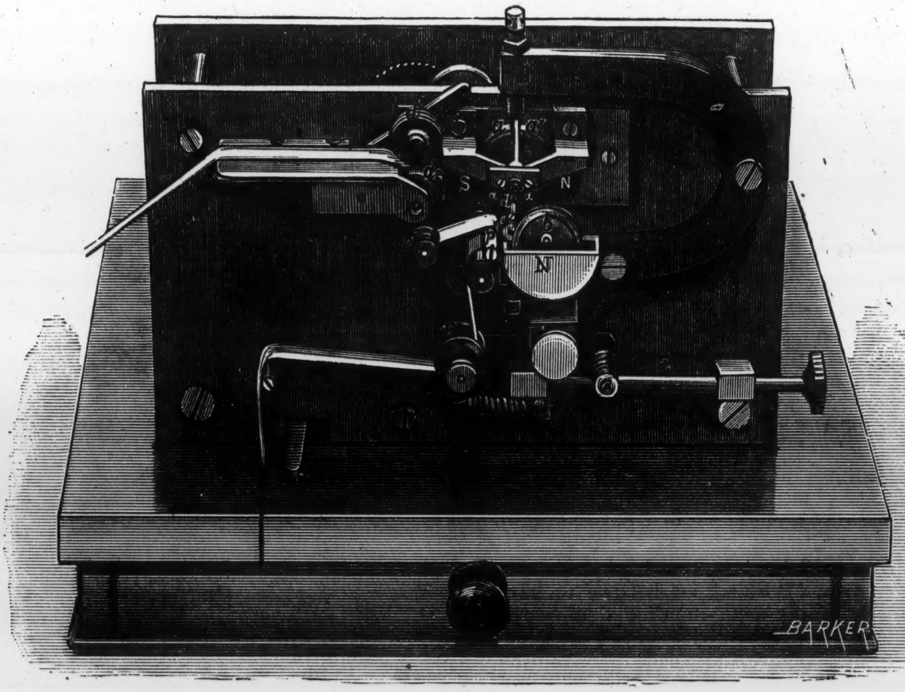


FIG. 6.

The advantages of this relay, says the inventor, accrue from the fact that it is of very simple construction, and therefore it can be readily, and with ease, adjusted and controlled in its action. Moreover, in such a relay there is less friction due to the movement of the working parts than in any other relay of the kind.

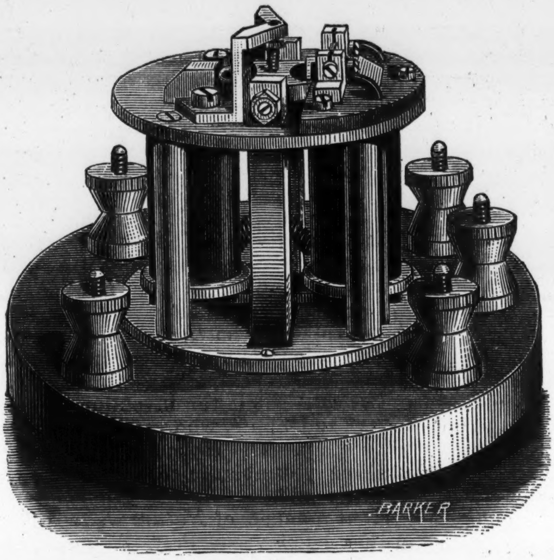


FIG. 5.

In the Allan-Brown relay, for instance, compensating springs are employed in conjunction with the armature in order to retain the same in a certain or determined position. When such springs, however, are employed, the sensitiveness of the instrument must necessarily be prejudiced, and the adjustment of it rendered troublesome.

In the ordinary relay, when the current has exercised its influence upon the tongue so as to close the local circuit by making contact with the stops, and such current rises in potential, the said tongue is forced with increased pressure against the stop, and on the decrease of the potential of such current due to the battery or batteries being disconnected from or cut out of the circuit, the tongue does not commence to move back to its normal position, and consequently break contact, until the current has fallen to zero.

In the Ebel relay, however, when the actuating current is passed, then the poles, N′, S′, of the electro-magnet, cause the armatures, *a* and *a′*, to move in one direction or the other, so that the arm, *d*, is brought in contact with and consequently closes the circuit through the stop, *c* or *c′*; but such armatures are free to continue their movement independently of the arm, *d*, so long as the current passing increases the effect of the electro-magnet; when, however, the current decreases in the slightest degree, the arm, *d*, immediately commences to return to its normal position, this movement taking place prior to the current reaching its former strength or falling to zero.

The general form of the relay is shown by fig. 5.

In the " cable recorder," which is an adaptation of the principle of the relay just described, the Morse signals can be recorded by the current directly received from the cable. The advantages accruing from this recorder are mainly due to the small, compact, and simple form of the electrical mechanism which can be arranged or fixed in a very limited space.

Fig. 6 shows the instrument. The paper strip is shown as arranged to be drawn from a drawer in the base or base-board of the apparatus, from which it passes over leading rollers, *p*, p^1 and p^2, to the friction rollers, d^1 and d^2, between which it is drawn by the movement imparted thereto by clockwork mechanism. This mechanism also causes the disc, *b*, to revolve in the ink well, such disc being so arranged as to constantly distribute the ink to the auxiliary ink disc, *e*; the latter is attached to the arm, *d*, which is combined with the spindle or axis of the compound armature, *a*, *a′*, arranged in relation to the poles of a permanent and electro-magnet, and adapted to operate as described in the case of the relay. The electrical mechanism in this recorder acts in precisely the same manner as the cable relay, inasmuch as in the latter the arm, *d*, effects contact with the stop by making and breaking the local circuit, whilst in the recorder such arm, *d*, throws the roller or disc, *e*, into contact with the strip, and consequently causes signals to be recorded thereon. The leading roller, p^1, is rendered adjustable through the medium of the regulating screw, *i*, so that the extent of movement of the arm, *d*, and the disc or roller, *e*, thereon, may be varied as desired.

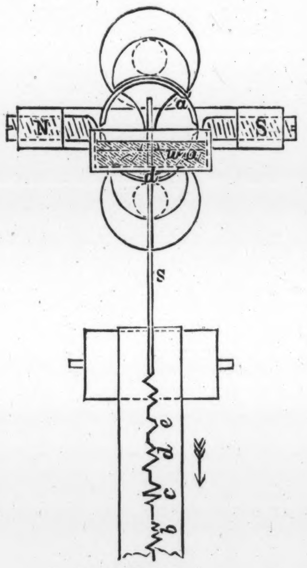


FIG. 7.

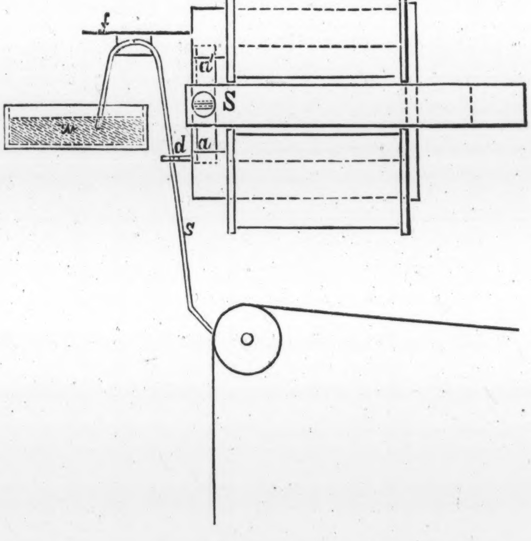


FIG. 8.

The working capacity of this recorder in no way falls short of that of the relay, and may be said to be more advantageous than the latter, inasmuch as its employment on cable stations simplifies the apparatus required, and consequently reduces the amount of attention necessitated with respect to adjustment, and therefore the cost of maintenance. Moreover, by reason of the lightness of its various parts, this recorder is especially applicable for ensuring high speed in ordinary circuits.

In addition to the recorder, as above described, being applicable for producing telegraphic signals in the Morse code, it can also by a slight modification be adapted to record signals on the mirror code. This arrangement is illustrated by figs. 7 and 8.

In this arrangement the armatures, *a*, *a′*, are shown placed vertically. *s* represents a syphon of fine glass suspended upon a fine fibre, *f*, and arranged to dip into the ink well, *w*. This syphon is attached to the compound armature, *a*, *a′*, by the arm, *d*. In such an arrangement the ink constantly flows through the syphon and passes out at the lower end on to the paper strip, the latter being fed or moved along by suitable mechanism so as to produce in ink a straight line, so long as no current passes through the apparatus. So soon, however, as the electro-magnet is affected by the passage therethrough of the electric current, and the armature, *a*, *a′*, is consequently moved, the syphon is likewise through the arm, *d*, actuated so as to trace a wavy or zigzag line upon the paper, showing the successive deflections to the right and left.

An Electric Railway Brake.—Experiments have been made at Cincinatti with the new electric railway brake, states the *Electrical Review* of New York, with good results. The tests were made on the Cincinatti, Washington, and Baltimore division of the Baltimore and Ohio Railroad. The brake has been in use for several months, and the special trial spoken of was made with a heavy coal train of ten cars, each car weighing, empty, about 11 tons, and having a tonnage capacity of 40,000 lbs. The brakes were applied only to the freight cars and caboose, there being none on the locomotive or superintendent's car, and no hand brakes were used. The loaded train, with full steam on, was put to a speed of 48 miles per hour on a down grade of 68 feet to the mile, and brought to a dead stop in 37½ seconds after putting on the brake, the distance run in that time being 445 yards, exact measurement.

THE INDIA RUBBER, GUTTA PERCHA, AND TELEGRAPH WORKS COMPANY.

THE recent cable work carried out by the above company has been remarkable for the rapidity with which it was effected. In the short space of 12 days the *Silvertown* made the voyage out from the Thames, took a large number of soundings, and successfully laid the cable between Gran Canaria and Lanzarote. The result of the soundings referred to showed the great necessity of carefully ascertaining the exact nature of the bottom over which it is proposed to lay a cable. In the case in point it was found that an extensive projecting shoal existed in the route selected in the first instance, this shoal (at the southern extremity of the island of Fuerteventura) extending far beyond the limits laid down in the Admiralty chart. In order to avoid this shoal, the length of cable actually laid (165 knots) had to be a little in excess of that at first estimated for.

On the completion of this section of cable the *Silvertown* proceeded to Teneriffe, where she was joined by the *International*, which had just completed her work of laying the Cape Verde Islands' cable, and of taking soundings amongst the islands lying towards the African coast and Teneriffe.

The *Silvertown* then laid a coast section between Santa Cruz, the capital, and the southern extremity of the island at Medano Bay, the length paid out being 35 knots.

The *Silvertown* next commenced laying (from the above-mentioned extremity of the island of Teneriffe) a section of cable towards Senegal. This section was paid out at the highest speed yet attained in cable work, the length of 219 knots being completed in 24 hours, a rate of over nine knots an hour. In order that the French engineers (who accompanied the expedition on behalf of the French Government) might examine upon the comparative merits of St. Louis and Dakar (about 100 miles to the south of St. Louis) as a landing place for this section, the cable was cut and buoyed in 1,600 fathoms of water at a position about 90 miles to the west of St. Louis.

The *International* (which had accompanied the *Silvertown*), during the laying, took soundings from time to time, in order to assure the position, and on the cable being cut, remained to watch the buoy.

After St. Louis had been thoroughly examined the *Silvertown* proceeded to Dakar, where a survey was made of the possible landing places. The French engineers eventually selected St. Louis, and the ship consequently proceeded to the buoyed end of the cable, and after a little trouble, owing to the prevalence of a strong wind and heavy cross sea, the end was brought to the surface and spliced on to the cable on board, and the *Silvertown* paid out towards St. Louis, at which place a landing was effected without delay. The total length of the section was 864 knots. The landing of the shore end was carried out by means of collapsible balloon buoys, which admirably answered the purpose of enabling the work to be effected through the heavy surf which continually beats on the coast where there is no shelter from the Atlantic swell.

On the completion of the section, and after tests had been taken and the cable accepted by the French engineers, the customary rejoicings took place. The ships then separated, the *International* proceeding to take soundings along the African coast, and the *Silvertown* going to Lisbon.

A very great deal of interest was manifested by the authorities at Lisbon on the arrival of the vessel, due to the work which had already been done and which was likely to be done for the Portuguese Government. The first official visit to the ship was made by the ministers and foreign representatives. The press representatives and scientific and commercial authorities also visited in large numbers, and finally the Royal Princes and the King and Queen honoured the ship by their presence, the King speaking in the most flattering terms of the work that had been done by the India Rubber Company, and wishing success to the future enterprises along the African coast.

THE NATIONAL CONFERENCE OF ELECTRICIANS, PHILADELPHIA.

(*Reported specially for the "Electrical Review."*)

IN our issue of Dec. 27th we concluded those matters discussed by the Congress of Electricians as far as the subject of "The Theory of Dynamo-Electric Machines." This, however, by no means exhausted the proceedings, and we now purpose continuing our report of the Conference, recommencing with the paper read by Prof. NIPHER on "The Electrical Transmission of Energy." Said the Professor :—

Some time last year I began an experimental investigation of an electrical generator and a motor with the view of determining the relations between the quantities that were involved. Perhaps I could bring out my ideas more clearly if I were to put them in the form of a graphical solution of the problem. I cannot say but that much of the ground has already been passed over in a more or less fragmentary way, and the object of the present discussion is to make a re-examination of the whole subject as completely as possible.

Suppose we have two machines, A running as a generator. Let G represent the number of revolutions per minute of its armature. And another machine, B, running as a motor, the number of revolutions of which being represented by N. If we now run B as a motor without any load on its pulley, the relation between the speed of the two machines will be represented by a straight line, this (indicating a height upon the vertical axis) being the motion of the generator when the motor is just about to start. If we put a load of one pound upon the motor the generator will be brought to a still higher speed before the motor starts. The relation between the two speeds will be again represented by a straight line. The greater the load upon the motor the further up these lines will be drawn. L will indicate the load, which is constant on the motor. Now, this point being determined, suppose that the two machines are connected with dynamometers of the form suggested by Prof. Brackett in such a way that the power applied to either of the machines may be determined when it runs as a generator, and the power yielded by the motor being measured, let us say, by a brake. Then this determination, together with the dynamometer observations, enables us to determine the amount of power which is applied to the generator and the amount of work which is delivered by the motor. Of course, by making the corresponding electrical measurements, the friction and so forth would also be determined.

I shall speak mainly of the total work which is applied to the generator and which is delivered by the motor. I will say that the brush friction and all that kind of thing will be counted in. We will have, then, let us say, three surfaces determined by these observations, the one surface being that of the useful work delivered by the motor. That is to say, at each point on these lines we shall be able to construct the ordinate which will determine a point in the surface of useful work delivered which we will call W'.

In the same manner we get the surface of total work applied to the generator, and if we let that be represented by W, we can represent by their ratio the efficiency of the couple. The efficiency surface can also be laid off in this way. Now the section of these three surfaces, making G constant, is the so-called "cap section."

We shall have a gradual increase in the work delivered, which will at some speed or other of the motor reach a maximum. The total amount of power given to the generator will be represented by a line drawn in this manner (indicating), near a straight line. In fact so near so, with the machines that I have worked with, that it could not be considered anything else but a straight line.

The efficiency surface will be represented in the section by a curve running between to a maximum like this (indicating), and going down to zero at this point. That section is well known. It is simply a section of these three surfaces. The lines of equal efficiency are more interesting than the lines of work delivered. The lines of equal efficiency will be represented on this plane as contour lines. This is the first line (indicating), and you see how it is zero here because the motor does not revolve, and zero here because it carries no load. Over here we have represented the high rate of speed, corresponding to the small load. These lines on the other side represent a similar set, if we were to reverse the machines, driving the motor as the generator. We should have a similar set of surfaces on the other side which would be symmetrically placed if the two machines were alike. These lines would be parallel with equal machines, and would always diverge if the machines were not alike. The distance between these two lines would be increased by putting in a line resistance and if the two machines could be made reversible, the lines would coincide, and the two surfaces would touch each other at that point.

Now, suppose that we have reached this point where the generator is running a motor without a load. If we put a belt on the motor and cause it to run at a higher speed, then, of course, it will require less power to drive the generator, and at a certain point the back current produced by the revolution of the machinery will exactly neutralise the current given by the generator. In other words, the current will become zero at that point. Suppose that E represents the surface of useful work delivered, and E' represents the other surface. Then suppose we increase the speed of the motor to a still higher degree, we shall pass into the corresponding surface on the other side through a region where the power is applied to both machines, and the curve will continue in the other surface. Here is where the machine, B, driven as a generator, will just drive the other when unloaded. The pull on this machine is a minus quantity, because it is in opposite direction to the force applied on the brake-arm. Now, at a point mid-way (of course, whether mid-way or not would depend upon the two machines) the work applied is simply that of friction. To the efficiency curve we can give no physical interpretation in this case, because the signs of the two works are unlike.

When we pass into the other section, the other sheet of this surface becomes the surface for W, that is to say, the total power applied. We are going through this surface, which may be called the negative surface, in a direction at right angles to the cap section. In this direction the surface of efficiency is also a maximum, but the surface of useful work delivered has no maximum. That is to say, these lines run upward, but do not pass through a maximum.

My proposition was, to examine and determine, first, the constants for these surfaces, as accurately as possible for certain types of machines, taking some one machine as a standard, comparing others of the same type with it, in such a way that these constants may be determined as quickly as possible, so that I should get the empirical formulæ which would be sufficiently comprehensive to represent the whole case, and which would be more manageable, perhaps, than those which have been theoretically deduced by Clausius, and which are really approximations. It would also be advisable to experiment on different armature-types of machines; for instance, the Gramme, which is the one I have already used, and, perhaps, the Edison machine. I have simply presented these views of the work in order to find out what may be thought of it by the members of the conference. It seems to me worth doing, but I would like to hear some other opinions on the subject.

Mr. SPRAGUE: I would like to ask how these machines were tested; and I would also like to ask as to the Gramme machines, how they were excited, whether the field magnets were in a series with the armature, or whether they were in compound.

Mr. NIPHER: They were in compound. I think in some of our machines we found some of those lines to vary very differently from those of the series wound machines.

Mr. PREECE: I would like to refer to a matter touching upon the electrical transmission of energy, which I think possibly may interest the members of the conference, and that is the transmission of currents of electricity for the purpose of producing artificial illumination. You have in practical use in large cities in this country various types of machines for electric lighting, and large plants where the electrical energy produced at one end of the line is sent out to various points along the line for the purpose of utilising it and converting it into luminous or radiant energy. Some of the lines I know from experience amount to as much as twenty-one miles of No. 6 copper wire used in systems of arc lighting. It therefore becomes a matter of no little interest in considering the efficiency of the dynamo-electric machines to consider their efficiency, not so much as regards their ability to convert mechanical work into electrical energy, but also, in another sense, you might say, of the ability of the electrical energy so produced to be readily transmitted into radiant energy. This is a matter of exceedingly great and practical importance.

The question to my mind is not as to what is the best type of machine for producing the highest possible equivalent of electrical return, but as to what is the best type of machine for producing that kind of electrical energy which can be transferred to a distance, and which can be most economically converted into light. This, of course, would necessitate the consideration of whether, according to the knowledge we have, we can progress much further and utilise incandescent or arc lighting. We will take up first arc lighting (I am merely suggesting this as a matter of thought to the conference); and this idea would appear to come up whether it were not absolutely necessary in taking into account the economy of the dynamo-electrical machine, to consider the number of feet-pounds of energy absorbed by the machine and returned not in electrical energy, but as returned in candle-power at the lighting point. Suppose a given amount of energy was present in the electrical current, the question would be which would give the most economical return of light, a high electromotive force or a low electromotive force. I throw this out simply as an idea. I would like to have any gentleman who has any remarks to make take this point into consideration.

Prof. NIPHER: I observe that I left out one thing which I intended to bring in, and that is, that the lines of efficiency are represented by lines which rapidly increase in distance from each other, that is, the distance between successive lines of equal efficiency become further and further apart. The lines of that surface determine the difference of efficiency at maxima and minima points.

Here we will say that the efficiency is 20 per cent. Much greater efficiency cannot be obtained under these conditions in the generator, running at a high rate of speed and the motor carrying a heavy load.

The line giving the maximum work is also a straight line, or very nearly straight, and very nearly bisects the other horizontal lines.

Prof. FORBES: I would merely remark that I think it is a pity that a discussion on Prof. Nipher's paper should cease immediately, although it seems almost necessary that it should do so. It seems impossible in the brief way in which he has brought it before us to grasp the full bearing of the experiments made and the conclusions to which the experiments have led him. But it would seem that such an intensely suggestive method as he has brought before us should have a greater amount of discussion than it seems likely to have, owing to this fact, that considerably more attention than we are able to pay to it from the brief description which he has given us is desirable, and also from the fact that the subject is a new one.

I think it is very desirable that Prof. Nipher should let us have the benefit of the results of his experiments, and the conclusions, in order that we may be able to incorporate them into our work, and into our further considerations of the subject, if we find it desirable to pursue the same investigation, or if it is to be carried on in future. It seems to me that we should have some further discussion on this subject.

Prof. NIPHER: I would like to say, Mr. President, that it is my intention to carry on this work, and I presume I shall put the greater portion of next year upon it, provided it is not said that it has already been done or that it is hardly worth while to do it. I do not know but that a remark of that kind would discourage me a little.

Mr. SPRAGUE: I would like to make one comment on what Mr. Nipher has said. It might go to the question of efficiency. We have to consider not only that the dynamo itself should be reconstructed, out of which you can get only a certain percentage, but also the very fact that its energy must be distributed over long circuits. Take an underground system or overground system, which may be readily carried over a square mile of territory and with a per cent. of loss not exceeding 10 per cent. with recently constructed dynamos. The electromotive force of the generators must be very high, otherwise we are led to the fact that we are obliged to use underground conductors which must be of such large size that our space over which the energy may be transmitted for lighting would be altogether too large to enter into any commercial consideration at all. The same way for arc light circuits. We must there deal with very high potentials. Because we use high potentials we can use much longer lines and smaller conductors. Mr. Preece speaks simply of the use of arc light circuits for the purpose of illumination. I think just as wide a purpose would be that of transference of power, and those motors which can be perfectly self-regulating can be brought into circuits with arc lights and run just as efficiently as arc lights are to-day. They will be just as self-regulating and perfectly controllable as arc lights are.

I want to touch upon one point of electrical railways which nobody seems to have a desire to do. I wish to place myself on record as to what I think the future of the electric railway is going to be in this country, and that is, that high potential circuits are going to be used. The idea has been brought forward of low potential circuits to be used for short lines or long lines, and these potentials have been taken so low as 30 or 40 volts. Also the suggestion is to use one of the rails for conducting the return circuit. These questions will have to pass through the same stages as they have in electric lighting. We started out with one conductor and used the gas pipes as a return. We are using now closed metallic circuits for all kinds of lighting, whether arc or incandescent, and precisely the same thing will be done in the electric railway. The rails will not enter on any great line as one part of a circuit. there will be used a closed metallic circuit and a potential of four or five hundred or a thousand volts, and sometimes as high as two thousand volts.

I will give an instance in which low potentials are used and the disadvantages of such. The greatest maximum mechanical effect is when the counter electromotive force is one-half the initial. Let us take the electromotive force of 50 volts; I suppose that is high enough. The greatest mechanical effect is when the counter electromotive force is 25 volts. We want to transfer 10 horse-power, say, over any appreciable distance. We average, say, 800 watts per horse-power when it comes to practice—746 are the correct figures. If we are using 10 horse-power we have got 8,000 watts to take care of. The electrical energy is the product of the current by the electromotive force. Our current will be 320 amperes. In other words, in order to get that initial electromotive force of our motor of 50 volts, where our motive power has the greatest mechanical efficiency, we have got to use 16,000 watts to transmit 10 horse-power. Suppose we transmit that over 500,000 circular miles, that is a very fair-sized conductor. Suppose we have a single mile over which to transfer from our motor through our conductor and back again. In other words, we have something over 10,000 feet. The resistance is not less than twenty-three hundredths of an ohm to and return from our generator. The resistance of the generator with an electromotive force of 25 volts and 320 amperes of current would be about ·073 of an ohm. We have got a resistance in our conductors which is three times that in our generator, with the generator working at its best mechanical effects. We have got not less than one-sixth of our energies supplied to the generator used up in the motor itself. We are going to have a very low electromotive force, because we are going to have safety, but we have got to start with 124 volts at the terminals of our machines. I think it is not necessary to go into the question of longer distances when we are dealing with 50 or 100 or 200 horse-power at low potentials. We must use 500, 1,000, or 2,000 volts, it is perfectly certain; and the rails must disappear from parts of the circuit, and many safety devices be introduced to take care of the high potentials.

SECONDARY BATTERIES.

At the conclusion of Mr. Sprague's comments the President of the Conference called upon Mr. W. H. Preece, F.R.S., for some remarks on secondary batteries. As this is a subject which at the present moment is attracting considerable attention in English electrical circles, we are sure that Mr. Preece's paper will be read with much interest, although it is now some months since it was presented to our American cousins.

Mr. PREECE, after giving a short history of the secondary cell, and condemning the manner in which its value as a commercial article had been brought before the public, said, two or three other men had been working at the idea of secondary batteries—Profs. Tribe and Gladstone amongst these. They approached the matter in a truly scientific spirit, investigated it most carefully, and have determined the chemical actions which take place and developed the laws. The result has been that Mr. Tribe himself has brought out a form of secondary cell, although it is not yet in the market, that is a great improvement upon anything that has ever been brought out before. But all these persons have been working silently upon this subject, and have gone back to Planté's original work and have followed Planté's original method. The batteries that I am going to speak about are merely modifications of Planté's simple lead cells, the simple cell being two plates of lead placed in dilute sulphuric acid, one plate oxidised and the other plate pure.

Now, as regards the uses, I have made a great many experiments with these secondary batteries, and first I will speak of their use in telegraphy. Some time ago the idea was mooted that a considerable economy might be effected in the working of telegraphs if dynamos were used for that purpose. The dynamo machines are used by the Western Union Company to work their circuits centreing in New York. We tried them in England, but they failed with us, and for a very obvious reason, which is simply this, that in England we do not work with "closed circuits." We work our instruments with rapid reversals. Our automatic system, which is very extensive, is worked sometimes at the rate of 300 words per minute, with very rapid reversals of very minute currents, and it is absolutely essential that these currents should be uniform in their character. Now the currents produced by the dynamo machines are not uniform. If a telephone be inserted in a secondary circuit, of which the dynamo machine forms the primary circuit, you will invariably find, as I have done with the very best dynamos I have tried, that you can hear sounds which are indicative of variations of the current, and these variations are fatal to a fast speed of working.

But when you use a dynamo and utilise the current from it in preparing a secondary battery you then get a means by which you can produce currents of absolute uniformity. The secondary battery current flows out absolutely uniform. And again, it has the great advantage of giving you a battery with a very low internal resistance and a very high electromotive force. The electromotive force of an ordinary secondary cell of Planté's form is 2 volts. You may take it as a rule to be 2 volts; its internal resistance may be made whatever you like. I had a series of secondary cells made, one set being a Faure-Sellon-Volckmar and another Dr. Tribe's and the third set being simply Planté's. There were eight cells to each set. From each of these sets forty circuits were worked. That is, each battery had forty distinct and separate circuits, so that practically we had a hundred and twenty circuits running from these three secondary batteries. Although all worked for about three months (I think the exact time was 96 days) uniformly and perfectly, with no trouble that would necessitate even the glancing at them during this whole period of three months, without attention whatever, suddenly one failed, and immediately afterward another failed, and then the third failed. They were charged up again, and then they went on for another three months (I did not repeat the experiment on the Faure-Sellon-Volckmar one), and they have behaved as well as one could possibly wish; so much so that one of the first duties that I wish to discharge on my return to England will be to arrange for a large supply of these secondary cells, and for their use on a large scale at our General Post-Office. We have in use at the General Post-Office in London 650 circuits centralising there, and we are now utilising about 22,000 cells. I think it more than likely we shall be able to work the whole of those circuits with probably not more than 5,000 secondary cells. We will still have to use a considerable number of cells for certain circuits, and for local batteries, but I have no hesitation in saying that the secondary batteries were absolutely perfect and that they result in a very considerable economy.

Now, as regards electric lighting. I have already used secondary batteries for electric lighting. I have used them in the Post-Office and I have used them for my own house. My house is in a portion of the country through which no lines pass for the purpose of electric lighting, and they cannot be found within a reasonable distance, so if I want to light my house by electricity I must be dependent on my own supply of electricity. I light my house by gas, but I burn my gas in my garden, and I extract from it that which I want; namely, light, and I discharge into the air of my garden that which I do not want—namely, poison. My gas is employed in working a small gas engine of two horse-power. It is the gas engine which works a small Gramme dynamo, which, when worked at its full power gives me 42 volts and 52 ampères. These 52 ampères are directed into seventeen cells; the cells are Planté's original cells. The plates themselves are two feet square and in each cell there are twelve of these lead plates. The lead plates are made up of four thin sheets of lead, each sheet being about one-thirty-secondth of an inch thick, and they are perforated in squares regularly all over, and these four thin plates are tied together, almost woven together, with thick worsted, and I will tell you the reason presently for that worsted. They are arranged in pairs, six on one side forming one pole, and six on the other side forming the other pole. They are placed inside of an ordinary pitch-pine box, well pitched inside, and the insulation of the cell is maintained by a thin India rubber bag, which envelops the plates. It is a loose India rubber bag, about the same shape and size as the cell, so that when the plates are put in they force the India rubber out, and the bag takes the exact form of the cell, and gives a cell thoroughly water-tight and thoroughly electricity-tight. I have seventeen of these cells all arranged in a series, and my engine, which generates these currents and charges this battery, is in my garden. My gardener has the gas-engine under his charge; he is an ordinarily intelligent gardener. When he comes on duty in the morning he lights the gas in the gas-engine and starts the dynamo which charges my battery, and, when he goes away to his dinner, after the engine has been working for three or four hours, the battery is prepared. I go home in the evening. I have got a store of electricity. I have every room in my house fitted up. I have at my bedside a most charming little light, with no smoking and no trouble with a wick, and no heat; a mellow light by merely turning on my tap. I have the softest and most delicious light you can conceive of, thrown upon my paper or upon my book. I have had this going on for four months, and I have never had any bother except on one occasion when the gardener put his foot on the wrong place, and the head of the gas-engine came down upon his foot, crushing his toes, and the poor fellow has had to lose four of his toes. It would be impossible to estimate the importance of the use of these storage batteries. I have a strong impression that for all isolated places similar to mine, that the storage battery is an essential thing, and I think that some one is bound to work out this question. Several are now pegging away at it. Sir William Thomson spent much time in investigating this subject, and has given it a great deal of attention, but has not succeeded simply because he confined his attention to the Faure-Sellon-Volckmar form of battery. I confined my attention to the plain, simple Planté cell, untrammelled by any patent. It is at your disposal, and nobody will interfere with you. If anybody else chooses to follow my example, I think they can do precisely the same thing.

There is another field in which satisfactory experiments have been made with secondary cells, and that is in lighting up trains of cars by electricity. This has been done on one of our railways between London and Brighton. The railway company has been for some months past lighting up one of its express trains by secondary batteries. The dynamo is worked by the motion of the wheel, and charges up the battery during the time that the train is working, and the current is being extracted from the battery so that you have a light in your carriages which is perfectly steady and quite independent of the motion of the train. That leads me to a point which I omitted, and which led me to work so hard at secondary batteries, and that is that a secondary battery renders the current produced by the inconstant engine and the inconstant dynamo perfectly steady.

If your engine is unsteady, its pulsations will increase or decrease the light in the incandescent lamp, producing a flickering. This has been a fatal objection to the use of gas engines. They are very irregular. You can see every revolution of your gas engine, as, for instance, the Otto engine, with only an explosion at every other revolution. The Clerk engine is better, because you have an explosion with every revolution, but it is so unsteady that you can always detect the flickering in the lamp. But if you insert into the circuit a series of secondary cells, whose electromotive force shall be similar to the electromotive force required for your lamps, then you steady down your current, and your lamps work with absolute perfection.

It is a difficult thing to say that in making an appliance of any kind we have reached absolute perfection; but I can say this: That when you have a good secondary battery inserted in the electric light current, it renders your current uniform, and your light is as near perfection as you could wish.

Suppose that your lamp requires 50 volts, then you will require 25 cells, which may be plain, simple lead plates. They may be very small, and cost you a mere trifle. I should think, myself, that it would be quite possible to make cells for this purpose at a cost of not more than five shillings a cell. You put 25 of them in, and then when you join them up the first current that goes through simply charges up the lead plates—one is coated with oxide and the other is clear—and you get a counter electromotive force from that battery of 50 volts. The consequence is, no current whatever passes through the secondary cell unless it be raised up to exceeding 50 volts; and the whole current passes through your lamps unless there is a deficiency from the unsteadiness of the engine. Then the energy that is stored up in the battery passes through the lamps, making the light uniform, and in that way you get the steadying effect by the use of the secondary battery.

(To be continued.)

An Electrical Tramcar at Dundee.—It is stated that the Dundee and District Tramway Company is making arrangements for testing a car worked by electricity on its lines. The car, which is capable of carrying 46 passengers, can, it is said, be worked on almost any gradient, and the motive power is equal to eight or ten horses. The makers have offered the company the option of purchase at the end of a month.

REVIEWS.

*Military Telegraphy in Recent English Campaigns—Afghanistan, Zululand, Egypt,** By R. von FISCHER-TREUENFELD, a Retired Major and Head of the Military Telegraphs in Paraguay. Berlin : Vrittler & Sohn.

This work unavoidably touches on questions, strategical, tactical and political, which do not lie within the province of the ELECTRICAL REVIEW. Its main purport is, however, to expound the organisation of the English Field-Telegraph Corps, to give an account of its participation in actual warfare, and to consider the future development of telegraphy in military operations. With the English organisation of field-telegraphy the author expresses himself generally well satisfied. He contends that the characteristic principles according to which this new corps has been formed are correct not for the English army alone, but for all armies. He holds, with right, that for all telegraphic communications subserving tactical purposes, a purely military organisation of the telegraph corps is essential, civil telegraphists being completely excluded.

Not England alone, but Austria, Spain, Russia, Italy have constituted in time of peace telegraphic cadres to be filled up in time of war. Curiously enough, France and Germany have not adopted a similar plan. The functions of the corps are no longer confined to maintaining communications between the different main divisions of the army and with detachments. They extend to a participation in reconnoitering, in the movements of outposts and even in a battle. In the Egyptian campaign telegraphic operations were carried on under fire ; the tent which served as a station was repeatedly perforated by projectiles, but the dispatches were sent off quietly and free from error. During the battle of Tel-el-Kebir Lord Wolseley received dispatches from London. An interesting fact is here put on record in proof of the zeal of the telegraph corps. As soon as the battle was over they received the command to transfer the station at once to the railway station at Tel-el-Kebir. The cable was uncoiled from the waggon whilst going through the deep sand at a sharp trot, and within half an hour five kilometres were laid over the very field of battle without a halt, the men not even looking round to see the results of the engagement. It is mentioned that almost the entire field artillery drove over the cable whilst thus extended on the bare earth without injuring it.

The author is fully of opinion that the English telegraph service amply proved its efficiency in this short campaign. "The endurance, the accuracy and the zeal of the corps deserve the highest praise, especially if the difficult local and climatic circumstances are taken into consideration."

The apparatus and equipments seem to have proved no less satisfactory than the men in whose hands they were. The field-cable consisted of a central steel wire, surrounded by six copper wires, each of half a millimetre in diameter, the whole insulated with caoutchouc, and worked round with hemp. Its weight is 170 pounds per English mile, and it bears a strain of 270 pounds. As station apparatus served Morse writing instruments, and telephones combined with Theiler's vibrating transmitter, an instrument of extraordinary sensitiveness. As batteries were used Lelanchè elements. The author suggests that well-constructed elements on the Marie-Davy system would be preferable for military telegraphs.

Among the errors committed, not by the telegraphists but in connection with that department, was the commission of the task of cutting off the so-called Syrian line (through which the rebel leaders obtained information concerning the movements of the British army) not to a body of cavalry, but to three men, Captain Gill, Prof. Palmer and Lieutenant Charrington. The tragical end of this undertaking is too well known to need recital.

In common with Lieut.-Colonel Webber, the author regards optical telegraphy by means of the heliograph as an inseparable adjunct to telegraphic communication. Flat lands and the heated desert oppose considerable difficulties to optical signalling. Nevertheless, Colonel Webber—formerly a decided opponent of the optical system—saw during the Egyptian campaign reasons for a complete change of opinion. He points out, however, that the service in a hot climate is far more severe than that of the electric telegraph. Against this has to be set the absence of any line which could be cut off or "tapped" by the enemy. Major von Fischer-Treuenfeld points it out as a defect in the British army that it has no trained corps of signalmen.

He considers it also a subject for regret that during the Egyptian campaign no use was made of captive balloons provided with means of communication——optical or electrical—with the troops below. This is the more surprising as the British army is fully provided both with the *personnel* and the *materiel* required for military aeronautics.

*Vade Mecum for Technical Electricians. A Practical Manual and Note Book for Electricians, Engineers, Foremen, Mechanicians, &c.** Edited, with the cooperation of experienced specialists, by E. ROHRBECK. Second annual issue. Berlin : A. Seydel.

Now the practical application of electricity has become an important profession, a work like that before us has become a necessity of the day. The Vade Mecum begins with an almanack of the ancient kind. Next follow tables showing the weights of square and round copper and brass in kilos. per metre run ; a table of the weights and prices of copper ropes ; wire gauges, according to the German millimetre standard, the Birmingham, the Halifax, the new English, the Parisian, and the Westphalian scales ; a table for converting Siemens units into ohms ; a table for the strength of currents ; table of strengths of currents in ampères measured with the electro-dynamometer ; table of the ordinary units of resistance ; table of the absolute resistances and coefficients of resistance of metals at 0°, referred to mercury ; table of the specific resistances of liquids, referred to mercury at 20° ; table of the specific resistances of insulators after electrification for some minutes ; table of dimensions, weights, and resistances of copper wires ; influence of temperature on resistance ; influence of temperature upon resistance and conductivity of copper wires from 0° to 30° C. ; reduction of the resistance of copper to 15° C. ; reduction of ordinary gutta percha to 15° C. ; resistance of bad conductors ; loss of energy per 1,000 metres in copper conductors at different strengths of currents.

Next follows a condensed exposition of the doctrine of electricity, beginning with frictional electricity, and comprising a statement of Ohm's law, Kirchhoff's law, contact electricity, table of polarisation, the arrangement of a battery in series or for quantity, the electromotive force of an element, a list of the chief galvanic elements, accumulators of various constructions, thermo-electric piles, effects of the current, system of absolute measurement, electro-magnetic system of measurement, the laws of Ampère, galvanic and dynamic induction, Lenz's proposition, magnetic induction, motion of a closed conductor as regards a magnet, extra currents, the action of solenoids. Next we come to magnetism. Here is a reference to Coulomb's law, an account of the action of a magnetic field, a statement of the horizontal intensity,

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Die Kriegstelegraphie in den nueren Feldgügen Englands.

* Vade Mecum für Elektrotechniker. Praktisches Hilfs und Notizbuch für Elektrotechniker, Ingenieure, Werkmeister, Mechaniker, u.s.w. Hevausgegeben unter Mitwirkung bewaehiter Fach kraefte.

the western declination and the inclination of terrestrial magnetism in Central Europe for the current year.

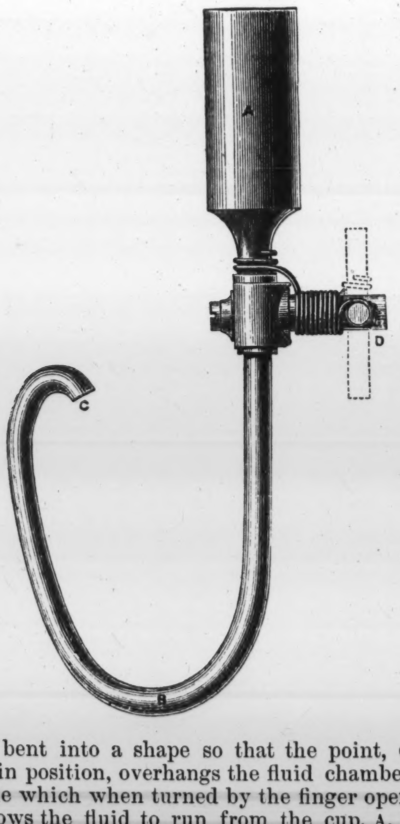
Under electro-magnetism the author gives the methods and instruments used for measurements, a table of the specific gravity of sulphuric acid, table of specific gravities compared with the very objectionable scale of Beaumé, from which our continental neighbours seem unwilling to emancipate themselves, measurement of differences of tension and of resistance, the use of Wheatstone's bridge, determination of resistance with the differential galvanometer, photometry, tables for comparing the German and English standard candles and the carcel lamp, and the measurement of mechanical work.

In the next chapter follows an account of dynamos and other electric machines for the production of power. Then follows a section on electric lighting, with an account of arc lights, glow lamps, electric candles, and semi-incandescent lamps. Next follows the electric transfer of power. In due succession we find chapters on electrolysis and galvanoplastics, telegraphy, telephony, electric railways, and lightning conductors.

It would be exceedingly difficult, even if at all possible, to compress a greater amount of useful information, clearly expressed, within such brief compass. We may add that the paper, though thin, is good, the type clear, and that we have not perceived any typographical errors—a point of no small importance in technical works.

JOHNSON AND PHILLIPS'S FLUID INSULATOR.

We give an illustration (half real size) of an ingenious little apparatus designed for the purpose of filling with insulating fluid the chamber in the well-known fluid insulator, patented by Messrs. Johnson and Phillips. A is a cup made of a size to hold exactly the right quantity of the fluid to fill the insulator chamber. B, a tube bent into a shape so that the point, C, when placed in position, overhangs the fluid chamber, and D a handle which when turned by the finger opens a tap, and allows the fluid to run from the cup, A, into the chamber of the insulator; this handle is fitted with a spring, which closes the tap automatically when the finger is removed.



This apparatus, which we have no doubt will be appreciated by those who use the fluid insulator, was designed by Mr. Wittkugel, of Kurachi, the ingenious mechanician to the Indo-European Government Telegraph Department.

LEGAL.

Re the Union Electric Light and Power Company, Limited.—Court of Appeal. Before Lords Justices Baggallay and Fry (Monday). This was an appeal by Mr. Andrew Hutton, a contributory of the company, from a refusal of Mr. Justice Pearson to remove Messrs. Dillwyn Parrish, Alfred Parrish, John Goddard, Jun., and James Fyfe from being liquidators of the above company. The four gentlemen above-named had been directors of the company, and it was urged that they were parties in certain transactions, the occurrence of which made their own interests liable to be in conflict with their duties as liquidators

Mr. Cookson, Q.C., and Mr. Grosvenor Woods appeared for the appellant, and Mr. Everitt, Q.C., and Mr. Bradford for the respondents.

The Lords Justices expressed an opinion that they had power to interfere with the decision of the judge in the court below, but they declined to do so in the present case. They considered, however, that there had been impropriety in some of the transactions complained of, and, although they dismissed the appeal, they directed that the liquidators should pay their own costs of the appeal personally, and not out of the assets of the company.

In re the Pilsen-Joel and General Electric Light Company, Limited and Reduced.—This was a petition by the above company for the confirmation by the court of a special resolution passed in March last for the reduction of the capital of the company, by cancelling 12,000 fully paid-up vendors' shares, or such of them as should be surrendered in pursuance of another resolution: by cancelling the sum of £1 per share on the 28,000 shares in the company, with £2 10s. called up thereon, and also on any fully paid-up vendors' shares which might not be surrendered, and by reducing the amount liable to be called up on the 28,000 shares from £2 10s. per share to £1 10s.

Mr. Phillpotts and Mr. H. G. Rawson were for the petition.

His lordship made the order, and directed that the company should continue the use of the word "reduced" as part of their title for a week, and that the order should be advertised in the *London Gazette,* the *Times,* and the *Standard.*

NOTES.

The Explosion in the House of Commons.—By the dastardly attempt last Saturday to blow up the House of Commons the electric lighting arrangements were greatly damaged. The direction of the light apparatus was conducted from a little office underneath one of the division lobbies, which was totally destroyed, and by the inpouring wreckage leads communicating with the various parts of the building were cut in two. The electric cables were likewise destroyed, and the whole of the apparatus so disarranged as to render it unworkable. Mr. Prim estimates the damage done in the Hall and House by the two explosions at from £10,000 to £15,000.

Electric Lighting in the Navy.—The electric lighting experiment which was begun on board the *Colossus* at Portsmouth on the 15th inst. was concluded on Thursday morning last week, the dynamos having been run continuously during the interval by day and night, the ship being lighted under the practical conditions which would be observed when at sea. No hitch of any kind happened to the machinery during the crucial ordeal, and only a few breakages in the lamps. The coal and oil used in the trial have been carefully measured and valued, and as compared with the simple cost of oil lighting it is computed that electric lighting is the cheaper by at least one-half. As the comparison stands, however, the *Times* says, it is unfair to the electric light. The engines which have been used for circulating the water through the condensers and driving the fans would at sea be required for the auxiliary engines and the common ventilation of the ship, and hence it would be unjust to charge all the coal consumed by them to the dynamo-driving engines. It has been consequently deemed necessary to run the circulating and fan engines for an additional 24 hours in order to determine the exact quantity of coal required to drive them, of which a proportional amount only will be placed to the account of the electric lighting.

As regards a comparison between lighting by "oil" lamps and the incandescent lamps, says a contemporary, that has not as yet been accurately obtained, although the consumption of oil and coal was carefully measured and valued. However, with a general comparison with the simple cost of oil lighting it was computed that the electric lighting was cheaper by about one half. So far as can be seen at present the experimental trial has been decidedly in favour of the electric light.

Electric Light on the Ice.—The electric light was used at the *fête* of the Paris Skating Club in the Bois de Boulogne on Tuesday night, and, with Bengal lights and the moon, effectively lit up a picturesque scene.

Trouvé's Electric Lamps.—An experiment was made last week by the police of the River Thames in the use of Trouvé's portable lamps for lighting dark spaces on that river. The trials were made from the river opposite the Houses of Parliament, and it was found that moving objects not absolutely black were shown brightly at 30 yards distance, less distinctly but discernibly at 50 yards.

Electric Lighting in Printing Offices.—The printing offices of Messrs. W. Brown & Co., St. Mary Axe, have recently been lit by electricity, the lamps used being the Swan incandescent, of which there are 50 of 20 candle-power. The dynamo is a 50-light Gramme shunt-wound, made by Messrs. Stanley and Davies, of Hyde (supplied through their London agent, Mr. C. R. Heap), and the installation has been put up by Mr. A. C. Devey, 6, Mincing Lane.

Electricity v. Gas.—Mr. O. E. Coope, M.P., who in January, 1883, and January, 1884, wrote to the *Times* giving particulars of the installation of electric lighting at his residence, Berechurch Hall, together with the relative cost compared with gas, has now made public the results of the last 12 months' working. These, he says, have been such as to confirm the statements and conclusions given in his previous letters (which we reproduced at the time of their appearance); the lights have given even more satisfaction, if possible, and the whole of the machinery and conductors are working as well as when they were first put in. The expense has been about the same as in the previous year, being rather under what would have been paid for gas. Mr. Coope expresses his amazement that greater progress in electric lighting has not been made in this country, especially in regard to the illumination of large country houses. He asks, Is it that the owners of these latter imagine that by delaying they will be able to take advantage of some great discovery and get the electric light for a tithe of what they would now have to pay? In answer, he assures them that if he had to light Berechurch Hall afresh to-morrow he would have the installation laid out again in exactly the same manner, and the cost would be almost as much as in the spring of 1882; and he is just as able to take advantage of any great improvement—which to his mind will come in the form of more economical incandescent lamps or more perfect accumulators—as those who are having an installation laid down to-day. With regard to lighting in towns, he thinks that such grandmotherly legislation as clause 27 in the Electric Lighting Act must injure private enterprise, and prove detrimental to the interests of the public.

Lighting a Mill by Electricity.—The experiment of lighting various rooms in a mill required for different manufacturing processes has been successfully carried out at the extensive woollen manufactory of Messrs. J. Taylor and Sons, Colne Road, Huddersfield. During the past year, and recently, the firm decided to largely increase the use of electric lighting in its works. The number of incandescent lamps in use for about 12 months has been 200, but Messrs Taylor and Sons have now enlarged the area of lighting, and have just had put down a Victoria compound dynamo, capable of lighting 700 or 800 incandescent lamps, and arc lights if required. At present they have 400 incandescent lamps of 20 candle-power each in operation in the warping, weaving, mending, knotting, and finishing rooms, the yarn store room, the pattern rooms, the warehouses and offices, as well as two powerful arc lamps. The dynamo is placed in the engine room, and is driven by the same engines that drive the general machinery of the mill. Forty horse-power is required to drive the machine. The contractors are Messrs. Thomson and Ritchie, who supplied the original installation, and who have entrusted the present work to Messrs. Woodhouse and Rawson, of London; it is being carried out under the superintendence of Mr. Reginald Laurence, Assoc. M.I.C.E., acting on their behalf.

Electric Lighting of the New Orleans World's Exposition.—The managers of the New Orleans Exposition have awarded the following contracts for lighting the buildings and grounds:—The Leavitt-Müller electric light, 800 arc lamps for the main buildings; the Brush electric light, 300 lamps for the Government and State exhibit building; the Jenney arc light, 100 lamps, with five iron towers for the grounds and the live stock department; Thomson-Houston, 100 arc lights for the machinery, extension and saw mill; Edison incandescent light, 4,800 lights for the music hall, horticultural hall, the art gallery, State headquarters, and offices. Each principal entrance and wharf will be lighted by six Leavitt-Müller lamps; altogether 1,500 H.P. is required for the electric lights which cost the Exposition over $100,000.

The Exchange at Inverness.—By the list of subscribers for its new Inverness district, with which the National Telephone Company has favoured us, we learn that there are altogether 46 offices, private residences, and public buildings in connection with the exchange. The subscribers include three bankers, six solicitors, six grocers and wine merchants, two hotel keepers, two steamboat agents, two commission agents, two brewers, a cab-hirer, an auctioneer, a firm of cabinet-makers, two steam sawmillers, a flesher, a medical practitioner, a distiller, a corn merchant, the lessee of the ferry, and others. The Town Hall, the police office, the Northern Infirmary, and the fire brigade station have also been connected; and wires have been placed between the police station and the houses of the members of the fire brigade, so that the men can be called out immediately on the alarm being given. Four call offices have also been established in different parts of the town. The district manager, Mr. James Townsend, who was formerly with Mr. Miller at the Aberdeen centre, informs us that 200 messages were sent by subscribers on the opening day, 300 and 460 on the two succeeding days; the call offices were also used to some extent.

Telephone Exchange for Johnstone.—The National Telephone Company is taking names for the establishment of a telephone exchange in Johnstone giving connection with Paisley and Glasgow. For a conversation of three minutes non-subscribers are to be charged sixpence.

The Telephone in Rome.—Up to a short time ago there existed in Rome two rival telephone companies, the "Impresa Romana dei Telefoni" and the "Società Generale Italiana dei Telefoni." As a consequence of the bitter competition the annual subscription to the former was 120 f., whereas the latter only charged their clients 100 f. Finally a fusion of the two societies was agreed upon, and almost the first result has been that the new company has endeavoured to raise the rates of subscription to 180 f. per annum, in addition to which they wish each subscriber to deposit 45 f. as a guarantee for the apparatus in his possession. As this demand is contrary to promises made at the time the fusion of the two companies was decided on, a number of the subscribers convened a meeting which was held at Palazzo Poli on Monday, the 19th inst., and was attended by almost 300 subscribers. A committee was appointed, the members of which have undertaken to lay a formal protest before the board of directors of the new company, and should this move be unsuccessful the matter will be brought publicly under the notice of the Hon. Genala, the Minister of Public Works.

The Fastnet Cable.—The laying of the cable to Lloyd's signal station on the Fastnet Rock has been completed, and vessels signalling that station can now be telegraphed to their owners direct from the Fastnet.

The Commercial Cable Company.—The Commercial Cable Company notifies that henceforth the line connecting Glasgow with its cable, will be open for transmission of messages to the United States, Canada, &c. The office of the company is at 67, St. Vincent Street, Glasgow.

Cable Interruption.—The Direct United States Cable Company's main cable between Ireland and Nova Scotia is interrupted. From particulars to hand, the cable appears to be broken about 330 knots by cable from Torbay, Nova Scotia, in shallow water, and, weather permitting, easily repairable. During the interruption the company will continue to accept telegrams marked "*Via* direct cable," which will be immediately transferred to the Anglo-American Telegraph Company.

Telegraph Revenue. — Receipts from April 1st, 1884, to January 24th, 1885, £1,420,000; from April 1st, 1883, to January 26th, 1884, £1,420,000.

Affray in Australia.—An affray has taken place in Western Australia between the Europeans and the Chinese engaged in the construction of the Roeburne telegraph line. The Europeans were compelled to fire upon the Chinese, and two were wounded.

Army Telegraph Appointment.—Lieut. Heath, R.E., has been selected to command the draft of the Telegraph Battalion, Royal Engineers, now being prepared at Aldershot for service with the Bechuanaland field force.

Technical Education.—Mr. Shaw, who was educated at the College of Science and Arts, Bath Street, Glasgow, and a Whitworth scholar last session, has been appointed, it is stated, to put down one of the largest electric light installations on the continent of Europe. Mr. Sharp, another Whitworth scholar, has been promoted from being head draughtsman to a manager's place at Messrs. R. Laidlaw & Sons. Mr. William Douglas, who won Dr. Anderson Kirkwood's 10 guinea chemistry prize and Chemical College diploma, has been appointed analytical chemist to two large sugar plantations in the West Indies, with good emoluments. Mr. D. S. Sinclair, who won the John Pender gold medal for electrical engineering and college diploma, has just been appointed an assistant at the Cavendish Laboratory, Cambridge University.

Alleged Libel by an Electrician.—Arthur Smithson, an electrician, of Manchester, has been committed for trial at Birkenhead upon a charge of having written and published certain libels concerning Mr. John Price, station master at Helsby, Cheshire.

An Electrical Crane.—For some years past a travelling crane has been worked by current at the Bourges Cannon Foundry in France, and M. Marinoni is now turning his attention towards applying the same system to a traveller 20 metres long and 7 metres high (65 feet by 23 feet), with a travel of 90 metres, or 295 feet, at his Paris works. A No. 5 motor of the Compagnie Electrique makes the lift up to 6 tons, while a No. 4 serves to effect the travelling motion. At 1,100 revolutions the generator gives out a current, the E.M.F. of which does not exceed 250 volts.

Electric Bell Fitting.—Messrs. H. and E. J. Dale, of Ludgate Hill, have lately completed the electric bell system at Hatchett's new hotel, Piccadilly. There are no less than seven indicators in various parts of the building.

The same firm has also fitted the bells and speaking tubes at the "Anchor," Cheapside, the British Museum, and new Treasury Chambers; the two latter for H.M. Office of Works. Messrs. Dale, we may add, are contractors to H.M. Office of Works for the electric and pneumatic bell work at Government Buildings in the London district.

Lightning Conductors.—At Glasgow a lightning conductor, of seven strand copper cable $\frac{5}{8}$ inch in diameter, and having a conductivity of 98 per cent., and fitted with a permanent testing wire, has been fitted on one of the shafts owned by the Glasgow and South Western Railway Company. After completion the conductor was tested, and the total resistance found to be ·5 ohm. It is said that this is the first lightning conductor fixed in Glasgow having a permanent testing wire. The contractor was Mr. David Tosh, Greenock.

The Glasgow Fire Alarms.—A Glasgow contemporary states that the cheese-paring policy of the local authority has extended to the management of the fire brigade, and the false economy which has actuated it in supplying the district fire brigade offices with inferior alarms has indirectly caused the loss of many thousand pounds to an East-end bleaching firm. The time lost in trying to work the alarm, which was found to be defective, and in delivering the message per boy, was considerable, and enabled the fire to gain great headway.

At a meeting of the Glasgow Town Council, held on Monday, the report of the firemaster was submitted. Among the recommendations made are:—(1). That direct telegraph communication should be established between the central and southern fire stations, and that the 17 southern district street fire alarms should be removed from the police to the fire station. A new station in the centre of St. Enoch Square to be in telegraphic or telephonic communication with the central station. Bailie Dickson said that at a recent fire at the Townhead the electric alarm had failed to act. The committee had seen the appliances after they had been removed from the wall on which they were fixed, and they were very much damaged. The whole alarm system—he meant the overhead wires—was in such a bad condition that very few of the wires could be depended on, especially after a storm.

Launch of a Cable Steamer—On Monday week Messrs. Robert Napier and Sons, shipbuilders, Govan, launched from their yard a steel screw-steamer named the *Electra*, built to the order of the Eastern Telegraph Company. The vessel is a sister ship to the *Magneta*, also constructed by Messrs. Napier and launched a month ago. The following are her dimensions, viz.:—Length, 230 ft.; breadth, 32 ft.; and depth, 24 ft. to awning deck, with a tonnage of 1,200 builder's measurement. The *Electra* will be fitted with engines of the compound surface condensing type, capable of driving her at the rate of $12\frac{1}{2}$ knots per hour. She has been furnished with the most efficient gear and appliances for lifting, laying, and repairing cables in the East.

Business Extension.—Messrs. Paterson and Cooper have added a department to their works at Little Britain and Dalston for the manufacture and supply of all articles required for the electrical deposition of metals, and have also laid down plant for electroplating.

Physical and Mechanical Institute for Germany.—Dr. Siemens, of Berlin, has offered the German Government a piece of land in Charlottenberg worth $100,000 for the building of an institute of mechanical and physical science. Preliminaries are already being arranged by Dr. Forster and Prof. Helmholtz.

Sir William Siemens.—Mr. Lant Carpenter lectured on Sunday at the Sunday Lecture Society on "The Life and Work of Sir William Siemens," illustrated by experiments, diagrams, and the oxyhydrogen lanterns.

Electro-technology.—A course of 15 lectures interspersed with practical demonstrations, will be given at the University College, London, by Dr. J. A. Fleming, on "Modern Application of Electricity in the Arts." The introductory lecture is fixed for February 6th, and the lectures will be continued every Friday at 4 p.m.

Overhead Wires.—A writer in a Glasgow contemporary says :—" I learn on good authority that, owing to the large increase of overhead wires, efforts will be made immediately to compel both the Post Office authorities and the telephone companies to place their new wires underground. This action has recently been taken by the local authorities in several of the English towns, and, considering the dangers which arise in stormy weather through the overhead system, and the accidents which have recently occurred, it is to be hoped our authorities will insist on their instructions being carried out to the letter."

The Electrical Exhibition in Paris.—The electrical exhibition in connection with the Sociéte Internationale des Electriciens will be opened on Sunday, the 15th of March next. The number and nature of the applications for admission made or announced up to the present date are sufficient to assure the success of the exhibition, which will be the first of the special series preparatory to the great International and Universal Exhibition of 1889. Applications for admission will be received up to the 10th of February at 3, Rue Segnier, Paris.

A Revolution in Telephoning.—This is how the London correspondent of a provincial contemporary speaks of the "Empire" telephone :—" I have just had an opportunity of inspecting the newest and certainly the most wonderful telephone in existence. It is of American nativity, and is simplicity itself. Neither magnetism nor electricity is employed, and the diaphragm appears to be only plaited wood shavings. A little walnut box, about 7 inches high, 7 inches broad, and 3 inches deep, was all the instrument that was apparent. Three slight taps with the finger-nail on the box brought a responsive series of taps from the other end of the wire, half-a-mile away. Then conversation commenced. The operator at the other end was asked to pronounce such words as 'Mississippi,' 'Missouri,' 'Heptograph,' &c., and the replies came loud enough to be distinctly heard a couple of yards away from the instrument. The playing of a harmonium was quite distinct and clear. By this system there is no need of a bell or a tube to hold to the ear. There appears to be nothing but the little 7 inch box, into which words are spoken at ordinary conversation pitch, with the result that they are emitted in greatly increased volume at the other end. It is not impossible that this invention may lead to a revolution in telephoning, at least up to distances of two or three miles." Our readers may recall to memory our note in the REVIEW of the 10th inst. on "Newspapers and Electrical Matters." It strikes us as being pertinent in this connection.

Patents in 1884.—The number of patents applied for during the year 1884, under the Act which came into force on the 1st January of that year, was 17,110. The largest number reached in any previous year was 6,241 in 1882. In 1883 the number was 5,993, and in 1881 5,751. In the first 11 months of the past year 1,095 patents dealing with electrical matters were taken out ; in the five preceding years the numbers were respectively 620, 845, 450, 260, and 300.

The Electric Railway Syndicate in America.—At a meeting for the purpose of uniting the different electric railway interests, it was decided that all the parties who are to come into the American Electric Railway Co., must agree to transfer to that company all their patents and inventions for electrical propulsion on railways in the United States, as a condition precedent to participating in the advantages of this arrangement, they to be compensated by participation in the stock reserved for patents and inventions, in the proportion fixed by the arbitrators. Sir William Thomson, of Glasgow University ; Prof. Charles R. Cross, of the Massachusetts Institute of Technology, and President Harris, of the Northern Pacific Railway, have accepted invitations to be members of the Expert Commission to test the rival electric motors and apportion the stock of the new company. It is understood that the commission will be empowered to employ expert electricians and practical mechanical engineers to conduct the test, under its direction, and its members will render a verdict upon the results of the experiments. At a subsequent meeting it was decided to issue an invitation to all reputable holders of patents relating to the subject of electric railroad propulsion, to assign the exclusive rights under their several patents for electric railroad purposes to the new company, and to receive from the board of arbitration their proportionate share of the stock according to the value of such patents.

An Electrical Torpedo Company.—The Sims Electric Torpedo Company has been incorporated in New York with a capital of $1,000,000. The corporators are Oscar Marshall, Henry P. Butler and Richard C. McCormick. Their purpose is to manufacture torpedoes, torpedo boats, submarine vessels, war ships, and other materials of war.

Magnetism.—The new Cavendish Professor of Experimental Physics at Cambridge (Mr. J. J. Thomson) will lecture on magnetism during the present term, which commenced on January 27th, on Tuesdays, Thursdays, and Saturdays, at 1.

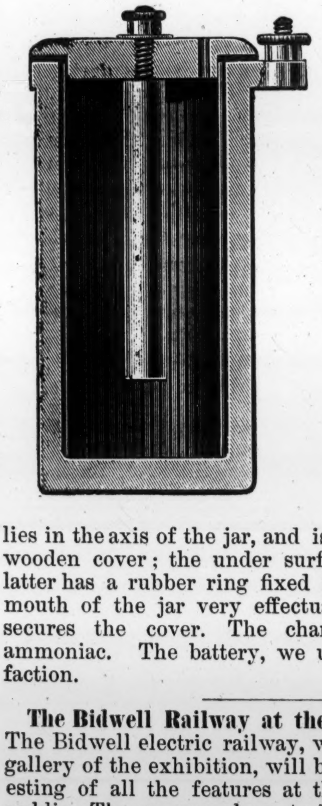
The Telpherage Company.—The Telpherage Company, we learn, has arranged its first contract. This is with the Sussex Portland Cement Company. It is also probable that a line will be erected for the removal of slag ; and other lines are under consideration. The company is admitted into the American ring (Edison, Field, Brush, Siemens & Co., &c.) for electric locomotion, and a very large number of inquiries come from abroad, which will probably, it is thought, result in a considerable extension of the system as soon as the cement works line is fairly running, but this is not expected to be completed before July or August.

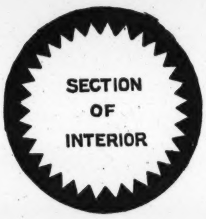
The Woodhouse and Rawson Electric Manufacturing Company, Limited.—The manufacturing department at Cadby Hall Works, Hammersmith, of Messrs. Woodhouse and Rawson's electric lighting business was transferred on the 22nd inst. to the Woodhouse and Rawson Electric Manufacturing Company, Limited, registered by Messrs. Freshfields and Williams on that date, with a capital of £100,000. The management will continue to be under the personal supervision of Messrs. O. E. Woodhouse and F. L. Rawson, who, together with Mr. W. C. Cazalet and Mr. Frederick Pennington, M.P., will be the first directors. The above arrangement will not affect the general business of Messrs. Woodhouse and Rawson, of 11, Queen Victoria Street, E.C.

Secondary Battery Patents in America.—Two important and interesting cases with reference to secondary battery patents in the United States have recently been decided. Interferences were raised against the Sellon and Swan patents, which belong to the Electrical Power Storage Company, Limited, by Starr and Brush; and in both cases the fight has been most obstinately, and at great cost, contested for nearly two years, appeal after appeal having been heard. The results of the last appeals are that priority of invention has been awarded to both Sellon and Swan as against Starr and Brush. As against Brush, the decision on this last appeal is absolutely final; but in the case of Starr a further appeal is still possible.

The "Specialists' Series."—"Gas Engines," by William Macgregor, being Vol. II. of the "Specialists' Series," edited by Drs. Paget Higgs and Charles Forbes, will be published on February 5th.

Applegarth's Patent Corrugated Battery Cells.—The illustrations we give show a very convenient and portable form of battery, devised by Mr. R. Applegarth, suitable for electric bell and telephonic work. The outer jar is of carbon with the inside surface corrugated, so that the latter is of a considerable extent, and tends to reduce polarisation in the cell. A zinc rod lies in the axis of the jar, and is fixed to a varnished wooden cover; the under surface of the rim of the latter has a rubber ring fixed to it, which closes the mouth of the jar very effectually. A simple clamp secures the cover. The charging solution is sal-ammoniac. The battery, we understand, gives satisfaction.





The Bidwell Railway at the Boston Exhibition.—The Bidwell electric railway, which is located in the gallery of the exhibition, will be one of the most interesting of all the features at the fair to the general public. The company has a train of two cars, which are of beautiful workmanship and richly upholstered. The electrical current which supplies the power is obtained from the Weston Company's works on Stanhope Street, and brought to the building by an overhead electric wire. The electric current not only propels the cars, lights and heats them, but it lights the streets through which it passes, and lights and heats houses as well, and also provides power for manufacturing purposes. This is illustrated by the exhibit at the fair. The cars on exhibition are supplied with one 5-horse power motor, weighing about 600 lbs., and carry with perfect ease 50 or 60 passengers.

Greenock Philosophical Society.—Mr. W. Lant Carpenter, B.A., F.G.S., delivered a lecture before this society on the 16th inst. on the "Conservation of Energy."

The "Gannet."—Orders have been received at Sheerness Dockyard directing an important alteration to be made in the armament of Her Majesty's composite sloop *Gannet*, which is being refitted for service on the Pacific station. Amongst other additions, she will be fitted with the electric apparatus for discharging torpedoes.

Earthquakes and Terrestrial Magnetism.—Mr. W. H. Preece having written to the Astronomer-Royal to ask whether any disturbance of the magnets or earth-current apparatus was experienced during the recent earthquake in Spain, Mr. William Ellis, of the Greenwich Observatory, communicates to *Nature* the result of an examination of the photographic registers in consequence made. As respects magnetic movement, the magnets on December 25th last and following days were generally quiet. But on looking more closely at the registers, attention was at once drawn to a small simultaneous disturbance of the declination and horizontal force magnets, occurring at 9 h. 15 m. on the evening of December 25th. Both magnets were at this time set into slight vibration, the extent of vibration in the case of declination being about 2′ of arc, and in horizontal force equivalent to ·001 of the whole horizontal force nearly. The movements have not the character of magnetic movements, and, if in reality produced by the earthquake, are of course simply an effect of the shock, the magnets being heavy bars suspended by silk threads some feet in length. About ten minutes afterwards there is doubtful indication in the horizontal force register of a second disturbance. There is no corresponding perceptible disturbance in the earth-current registers. No other similar motion is observable either on December 25th or on the following days. It may be remarked that the time of occurrence of the earthquake at Madrid is said to be 8 h. 53 m. p.m. Taking this to be Madrid time, it corresponds to 9 h. 8 m. of Greenwich time.

The Anglo-American Brush Electric Light Corporation.—The report and accounts for the year ending December 31st, 1884, of this Corporation has been issued, and an abstract of same is to be found in our "City Notes, &c." The directors are to be congratulated on their very lucid statements, and, indeed, on the generally satisfactory nature of the balance sheet when viewed as a whole and considering the past history of the Corporation.

We are inclined to think that the credit item, "Patents, &c.," £28,676, is sufficiently heavy, and shall be pleased to see the writing off of this account steadily proceeded with.

The only other item calling for special notice is that of "Stock"—being goods manufactured, in process of manufacture, and materials at work—£69,171. This is a very heavy item, and in regard to it the directors say that it represents "the minimum *cost* value of the stock on hand, stores, and goods in course of manufacture." Supposing the stock of manufactured goods, &c., consisted of wholly, or even partly, obsolete patterns, the cost would not represent the now proper value, and, therefore, this item is one which it is to be hoped has been sufficiently considered; the report of *old* stock on hand being, to its shareholders, the chief source of anxiety as regards this Corporation at the present time. We shall hail with satisfaction in the next report a lessening of this item, and think that with increased leisure to attend to this matter the present business-like board of directors will see its way to very materially reduce it.

An Electric Alarm or Time-signalling Clock.—An apparatus has recently been constructed and fitted for W. J. Twigg, Esq., of Dulwich, by Messrs. H. & E. J. Dale, from designs by Mr. Henry Dale, and is working most successfully. It makes contact, and thus causes to ring five distinct circuits of electric bells at any time that may be convenient for each circuit, as the time for ringing any circuit can be changed independently of the others, and be set as desired. The clock comprises a first-class 14 day movement with 24 hour dial, having both the old and new notation for indicating the time, and the electric contact cylinders are driven by the same movement. It has also further arrangements to render any bell or circuit silent, and also to signal to and fro on the same wires without interference with the clock. A duplicate of this clock will be shown at the coming Inventions Exhibition.

The Mackay-Bennett Cable.—The duplexing of the second Mackay-Bennett cable is now finished. The Havre section is expected to be laid at the beginning of next month.

Batteries for Electric Lighting.—Mr. Edward Dixon of Hull writes as follows to the *Eastern Morning News* respecting a well-known form of primary battery:—Let us for the sake of argument concede that it is the best and cheapest battery yet invented and it will be at once seen that I have no wish to run it down. Before investing on the strength of any prospectus, experience teaches most of us to be a little cautious. I think in this case there are reasons for caution. We are told that zinc at £14 10s. per ton is put into the battery and after it has done its work, a production is obtained used for making paint worth £20 per ton, and that there is therefore "a large margin to go on." Very little account is taken of the cost of caustic soda or of the roasting for an hour or so the precipitated metallic copper necessary to reproduce the oxide. Now, though a believer in miracles, I am not able to believe that the first article ever supplied to the public for nothing or produced at a profit is to be the electric light. To produce the electric light by any other battery than the one advertised, is admitted by electricians to cost about *ninety times** as much as to produce it by steam power and the familiar dynamo machine. We are therefore asked to believe that this new battery will be something more than ninety times cheaper than any yet invented, besides other advantages. In this case, as might be supposed, we shall find it in "the large margin," where we are told zinc at £14 10s. produces a valuable product oxide of zinc at £20, largely used for making paint. Now the best oxide of zinc used for making paint is worth from £17 to £18, and is not produced by precipitation. I never heard of the precipitate being used for paint grinding, and should be much surprised to hear of any manufacturer buying it at £10. It is not necessary to take up more of your space with roasting the copper.

Cleaning Boilers by Electricity.—A correspondent to a foreign contemporary states that existing boiler scale may be detached by keeping the poles of a 10 or 12-cell Bunsen battery connected with the ends of the boiler for 30 or 40 hours, and that afterwards the plates may be kept clean by a weaker current similarly applied.

Fire in a Telegraph Office.—At New York a fortnight ago a fire was caused at the headquarters of the fire telegraph system by the crossing of the telegraph wires with an electric light wire during a storm. The fire was subdued before much damage was done.

An Electric Railway in the States.—Articles of incorporation have been filed in the Queen's County (N. Y.) County Clerk's Office by a company which proposes to run an electric railway from Far Rockaway to the Long Island Railroad. The capital is fixed at $200,000.

Progress of Electricity amongst the Chinese.—The Celestials appreciate at the full value many of the improvements of modern civilization. In their naval and military services they are making use of electrical appliances, and in a report on proposed roads and telegraphs is expressed the opinion that a telegraphic line along the coast is an "urgent essential."

The Boston Electrical Exhibition.—At this Exhibition, which opened on December 8th, we learn from an American contemporary, the principal exhibits are those of Edison, composed of lamps and his private exhibit; and that of the American Bell Telephone Company. The Arago electric light is shown on the outside and inside of the building. The historical collection is small, comprising Western Union and fire alarm models. The Dudley Electric Manufacturing Company shows a system of individual calls for telephone lines. Seth W. Fuller exhibits a variety of electrical apparatus, &c. Blodgett Bros. exhibit their railroad time apparatus, &c. The New York Insulated Wire Company is represented. The New York Consolidated Electric Light Company has its dynamo in position, and its exhibit is progressing. Ocean telegraphy is graphically illustrated. The Rhode Island Telephone and Electric Company has its clock system working—as have also the American Watchman's Time Detector Company, the Martin Automatic Fire Alarm Company, the Municipal Signal Company, and Orcutt's Electric Railroad Signal. The Bidwell railway looks well, composed of tracks and cars, the former encircling the gallery. The cars, two in number, are built with open sides; the first car carries the driver in front where the apparatus is located. The power is obtained from a Weston dynamo on Stanhope Street, some distance from the building. The cars are lighted by electricity from the rails. The incubator man is here with his "electrical" exhibit. The "Orne" battery has a show case. Prof. Dolbear has his box on the main floor, and illustrates his telephonic system; he has a Reis transmitter connected with it, "to show that the Reis instrument *can* be made to talk, notwithstanding the sneers of an unbelieving world."

NEW COMPANIES REGISTERED.

Woodhouse and Rawson Electric Manufacturing Company, Limited.—Capital £100,000, in £10 shares. Objects:—To carry on business as electrical, telegraphic, chemical, and mechanical engineers, and to manufacture electric appliances generally. Signatories (with one share each)—*William Clement Cazalet, J.P., Dorking; *Fredk. Pennington, M.P., Dorking; *O. E. Woodhouse (electrical engineer), 20, Upper Phillimore Gardens; *F. L. Rawson, M.S.T.E., 68, Cornwall Gardens, S.W.; F. W. Pixley, 24, Moorgate Street; J. H. Ward, 11, Queen Victoria Street; J. C. Peache and R. Archbould, Cadby Hall, Hammersmith. Directing qualification, 50 shares. Remuneration—during the first year, £1 1s. to each director for every board meeting attended, and afterwards such amount as may be determined by the company in general meeting. Registered 22nd inst. by Messrs. Freshfields and Williams, 5, Bank Buildings, E.C.

Blackpool Electric Tramway Company, Limited.—Capital, £30,000 in £10 shares. Registered offices, Talbot Square, Blackpool. Objects:—To lay down tramways in the borough of Blackpool and its vicinity, and to work the same by electricity by means of Holroyd Smith's patent; also to enter into arrangement with the Corporation of Blackpool for public and private electric lighting. Signatories:—Thos. Shaw, M.P., 50 shares; T. H. Morriss, 15 shares; J. Oddie, 10 shares; R. Horsfall, 25 shares; G. H. Smith, 50 shares; all of Halifax; J. Moseley, of Ardwick, Manchester, 100 shares; G. E. Schofield, M.D., 20 shares; J. Bickerstaffe, 30 shares; and J. Broadbent, 25 shares, of Blackpool; T. Ormerod, of Brighouse, 50 shares. Directing qualification—Shares or stock of the nominal value of £100; the signatories are to appoint the first, and are to act as directors *ad interim*. The following appointments have been made:—Mr. Godfrey Rhodes, of Halifax, to be solicitor; Mr. M. Holroyd Smith to be consulting engineer, and Mr. R. Handley to be secretary. Registered 24th inst. by Mr. C. Doubble, 14, Serjeant's Inn, Fleet Street.

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* Although we are always glad to see such criticism as that of Mr. Dixon, we think that he has quoted erroneous figures here.—EDS. ELEC. REV.

* Signatories whose names are preceded by an asterisk are also directors.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

International Electric Company, Limited.—The annual return of this company, made up to the 12th inst., was filed on the 17th inst. The number of shares taken up is 40,268. Upon 26,668 the sum of £4 has been called, £1 10s. has been called upon 8,000 shares issued, with £2 10s. per share paid up, the remaining 5,600 shares being issued as fully paid. The total amount of calls paid amount to £105,827, and considered as paid to £48,000, leaving £12,845 unpaid. As compared with the previous return, the paid up capital has increased £23,810 15s.

Indian and Oriental Electrical Storage Company, Limited.—The annual return of this company, made up to the 12th inst., was filed on the 14th inst. The nominal capital is £280,000 in 80,000 shares of £3 10s. each. The number of shares taken up is 34,880. Upon 29,880 shares £2 5s. has been called up, and £3 10s. upon 5,000 shares. The total calls paid amount to £83,499 15s., and unpaid to £1,500 5s. The sum of £232 10s. has been paid on 120 shares forfeited.

Provincial Brush Electric Light and Power Company, Limited and Reduced.—The annual return of this company, made up to the 5th inst., was filed on the 23rd. The nominal capital is £155,357 15s., divided into 19,841 shares of £2 15s. each, reduced from £200,000 in £5 shares. The whole of the shares are taken up, and £2 10s. has been called upon them, the calls paid amounting to £48,905 5s., leaving £693 5s. unpaid. As compared with the previous return the paid-up capital has increased £213 10s.

Gülcher Electric Light and Power Company, Limited.—The annual return of this company, made up to the 18th ult., was filed on the 21st inst. The original capital of £300,000 in £5 shares is now reduced to £150,000 in £5 shares. The number of shares taken up is 9,849 fully paid shares and 16,935 ordinary shares. 4,999 paid and 848 ordinary shares have been surrendered, thereby reducing the numbers to 4,850 and 16,087 respectively. £3 10s. has been called up on each £5 share. The calls paid amount to £54,514 1s. 8d., and considered as paid to £49,245, leaving £4,758 8s. 4d. unpaid. The sum of £2,875 has been received for calls paid in advance, and £100 has been paid on 250 shares forfeited.

Australian and New Zealand Electric Company, Limited.—The return of this company, made up to 29th ult. was filed on the 21st inst. The nominal capital is £5,000 in £50 shares. 63 shares have been taken up, and the full amount has been called thereon, the calls paid and considered as paid amounting to £3,150. As notified in our last issue, the company proposes to wind up voluntarily.

CITY NOTES, REPORTS, MEETINGS, &c.

Eastern Telegraph Company, Limited.

THE 25th half-yearly ordinary general meeting of this company was held at the Cannon Street Hotel on Thursday, Mr. John Pender, M.P., presiding.

Mr. George Draper, the secretary, having read the notice convening the meeting, and the minutes of the previous meeting,

The Chairman stated that the revenue for the six months to 30th September, 1884, amounted to £309,569 against £283,070 for the corresponding period of the previous year. Over £19,000 of this was derived from long Government and Press messages, which compensated for the falling off in commercial telegrams. The Black Sea Company's traffic showed a sum of £2,023 against £623 in the previous year. The receipts for traffic with India were less by £4,000. The balance-sheet showed that they had £3,498 in shares of the Mediterranean Extension Company, which was now in liquidation. The working expenses were £84,907, £4,058 more than in the corresponding period, the increase being mostly of an exceptional character. The general expenses in London showed an increase of £2,542 occasioned by the suit with the Central News, and other expenses. The working expenses had increased by £1,994. Four new stations had been opened during the six months. There was an increase of £1,369 in travelling expenses, occasioned by bringing witnesses to England in the Central News suit. There was a decrease in station expenses, maintenance, renewals of electrical instruments, &c. The construction of cable tanks at Suez had cost £500; these tanks were absolutely necessary if they were to keep their cables in a thoroughly satisfactory state. Renewals had cost £31,189, an increase of £1,669. After charging all expenses, income tax, &c., the profits enabled them to pay a bonus of 6 per cent. per annum and carry forward £30,364. He thought he might congratulate the shareholders on the report he had placed before them. With regard to the decrease in traffic with India, they knew from long experience that the success of the telegraph, the increase or decrease of messages, depended more or less on the state of trade, and there had been a very marked depression of trade in India, as in England. Still, the account he had presented was a good one, chiefly in consequence of the state of things in China. Fighting was going on there between the French and the Chinese, and the result was a considerable amount of telegraphic communication; but he would rather look to a general state of active trade than to warlike operations for success. When the report was printed the cables were stated to be in perfect working order, but that day they had several cables interrupted; thanks, however, to their arrangements, and the fact of their ships being at proper points, he hoped in a very short time to have the cables at work again. While breakages occurred they must have ships; and having them, they had perfect confidence in being able to repair them. The directors had, he thought, looked forward more than some people would credit; they had their system so arranged in the Mediterranean, that if they had even four cables interrupted they would still be able to conduct their important traffic with the Continent, and with India, China, and Australia. The chairman then alluded to the deaths of Mr. Cameron and Mr. St. Leger Herbert, the correspondents of the *Standard* and the *Morning Post*, who were killed in the recent engagement in the Soudan, remarking that the company was largely indebted to the messages which the various correspondents from time to time passed over their lines. The public, too, was largely indebted to these gentlemen; and seeing with what valour they fought, and the position they occupied, so different to the military men who were crowned with glory for their achievements, he looked upon them as even greater heroes than those who met with reward for their success. These men had for incentives simply the satisfaction that they were doing their duty to their employers and their countrymen. The shareholders, he was sure, would agree with him in expressing the deepest regret at the great loss the nation had sustained by the death of those two great men. The last time he (the chairman) addressed the shareholders, he mentioned that they had connected Suakim with their system, and that Suakim was likely to be the opening to the Soudan; it was then generally supposed that any expedition sent from this country would go by Suakim to the Soudan. Looking at the hundreds of thousands which would have been spent by going in that direction, as compared with the millions expended in the other, he thought—and his opinion was shared by men of great experience—it was a pity on many accounts that the Suakim route was not taken. Still, all honour to the men engaged in the enterprise, and although they were not receiving the same amount of telegraphic communication from them as at other times, he trusted the result would be beneficial to the nation. They had completed arrangements for obtaining possession of the Mediterranean Extension Company. This was a small extension of line in the Mediterranean, no good to those who possessed it, but by obtaining it they had added a link to their chain. They had done the same thing in regard to the Direct Spanish Company; they had acquired such an interest in that company that they had the control of it, and it would become a valuable link in their system. When he last addressed them he stated that they had made arrangements with the Greek Government; these arrangements were so satisfactory to the Greek Government that it proposed a still further connection with some of its outlying lines, and had offered them an extension of 10 years of the subsidy, which would give them 33 years at £6,500 a year, and he believed that the fresh extensions would cost them something like £6,000, so that on the whole that was not an unsatisfactory arrangement. They had also opened a station at Perim, in the Red Sea, and an enterprising company had established a coaling station there, so that it was likely to become an important point. He concluded by moving the adoption of the report and accounts.

The Marquis of Tweeddale seconded.

Mr. E. P. Evans expressed great admiration of the abilities of the directors, but asked why it was necessary that the reserve fund should be kept at so large a sum. This had been accumulated out of profits, and he thought an additional bonus of 1s. might have been paid without affecting the stability of the company.

The Chairman, in replying, said probably never was there a time in the history of submarine telegraphy when the question of reserve fund was likely to be more prominently brought forward than now. Referring to companies outside their own, there were four Atlantic cables interrupted at that moment; if they had not a reserve fund behind them the value of the property would go down on the market to nothing. It was the reserve fund that was the backbone of the company; and they were getting a fair rate of interest on it. Notwithstanding that the class of water in which their cables were laid was such that they had no anxiety, he thought it would be bad management not to make themselves strong all round.

Mr. Newton gave his opinion that the interest received on the reserve fund should be credited to revenue, when they would have the satisfaction of seeing what was their exact revenue for the year; instead of this, £10,000 or more was carried to the reserve account.

The Chairman replied that they were very much in the hands of their accountants with regard to that matter. But they were always open to learn, and if Mr. Newton could convince Mr. Griffiths that his suggestion was a right one, he would have no difficulty in convincing the directors.

Mr. Sherwin remarked that after all the accountants were merely the servants of the shareholders, and if the shareholders felt that the revenue might be fairly increased by the interest on the reserve fund, they could not object.

The Chairman said their capital was £5,000,000, an he thought the reserve fund was far short of what it should be. Therefore he was not prepared to make any departure whatever—would not advise the shareholders in any way to depart from the practice established. Answering other questions, he said they found that it was desirable to get control over the Direct Spanish Company, and they purchased a certain number of shares, and placed on the direction Sir James Anderson and another of the board, so that they might look into the affairs of the company carefully. They found on examination that the reserve fund was practically gone, and there was no fund to enable them to restore the cables; and as a consequence they had been obliged to suspend the interest on the preference shares.

Mr. Newton said he quite approved of a large reserve fund, make it as large as possible; but he did not approve of not considering it as part of the capital.

The Chairman said that was merely a matter of account. The motion for the adoption of the report was then put and carried.

Mr. John Pender and the Marquis of Tweeddale were re-elected directors, and the auditors, Mr. Dever and Messrs. Quilter, Ball & Co., were re-appointed.

A vote of thanks to the chairman was carried, and the meeting dispersed.

Cuba Submarine Telegraph Company, Limited.

THE 27th ordinary general meeting of this company was held at the offices, 61, Old Broad Street, on Wednesday, Mr. Joaquin de Mancha, chairman of the company, presiding. The shareholders present numbered eight.

Mr. James Scott, the Secretary, having read the notice convening the meeting,

The Chairman said: The report and accounts having been taken as read, I will offer very few observations, for I consider they are so clear and so substantially convey the whole of the proceedings of the last six months, that they require very few observations on my part. I think we must congratulate ourselves that the report is so very favourable, taking into account the great difficulties all sugar-producing countries have been experiencing for the last few months. Cuba has produced 981 messages more than in the same period last year, which I think is very satisfactory for our interests. I am only sorry to say that the receipts have not kept up in the same proportion, for, although we have carried more messages, our income has been about £400 less than it was for the same period of the previous year. This, as I before explained, arises from the great knowledge of the gentlemen who use the telegraph; they are so well versed now that one word conveys the meaning of a whole sentence. Besides adding to the reserve fund its own interest, which amounts to £1,400, we have been able to add out of the profits of the half-year £550 more, bringing the reserve fund to £60,000, which you will no doubt think, with us, is a very favourable sum to have at our disposal. This sum we, of course, hope to continue adding to, for there is always the danger of the cables breaking down, in which case £4,000 or £5,000—in one instance £20,000 were expended—may be required to effect the repairs. The money we have in hand, you will see, will enable us to pay £3,000 on the preference shares, and we will recommend to you that a dividend at the rate of 7 per cent., free of income tax, be paid, which will absorb the whole amount except £440 carried forward to the next account. It is very satisfactory to read that the cables are all in excellent repair. It has been necessary for us to buy a small piece of land for putting the cables in repair; this rather increases the expenses, but we consider the money well laid out, as it has enabled us to have all our spare cables looked to, so that in case of necessity they will be available for our purpose. With regard to the question of the taxation to be returned by the Spanish Government, since the report was written we have had a letter and a telegram from Mr. Keith, and it seems that the Government has no funds at present to pay us, but it promises that our claim shall be paid out of the first cash remittance from Spain, to be received on the 5th proximo, so that we hope that line will be expunged from the next report, and £1,100 received and carried to profit and loss. I think those are all the points I have to call your attention to, and therefore I will now ask you to pass this resolution: "That the report and accounts now submitted be received and adopted."

Mr. Alexander Low seconded.

Mr. Woodward asked what was the nature of the securities mentioned in the balance sheet, on which loans had been advanced to the amount of £4,000. He thought it was unwise that one half of the reserve fund should be invested in three banks, and moved as an amendment: "That no larger sum than £5,000 of this company's money be lent to any one bank or for a longer period than six months."

Mr. Prüst seconded the amendment.

Mr. Griffiths suggested that it would be wiser to accept the report and bring forward the proposition afterwards. He had sometimes himself thought their investments in banks were too large; but, on the other hand, all their money was not in one bank, and though one bank might be unable to pay, they would not be deprived of all at once. There was some force in the proposition, for it was necessary that so valuable a property should be secured, and he would suggest whether a small portion might not be invested in consols, railway debentures, and other first-class securities. He would like to be informed, too, as to the length of the concession from the Spanish Government.

A Shareholder, whilst approving of the suggestion made in Mr. Woodward's amendment, pointed out that they would not be able to get 5 per cent. for their money, which they received under the present arrangement, if investments were made in other securities; still he thought an addition of 4 per cent. would be ample, half year by half year, to be added to the reserve fund.

The Chairman, replying to Mr. Woodward's question as to loans, said the spare money which they had in hand, amounting to £4,500, preparatory for the dividends, and which they could not employ in anything more profitable, they lent on the Stock Exchange to a very respectable broker on securities worth £6,000. Most of them knew it was a very difficult thing at the present time to employ money at 5 per cent. It had been said that there were plenty of securities that would pay 4½ per cent.; he would be very glad to learn what they were, and to invest in them. It was a matter of the greatest difficulty to get 3¾ on any railway debentures, and there was hardly a railway in England that would pay more than that. He should not like to have it in the way of an amendment, but if they would express their ideas that it would be more prudent not to have more than £5,000, and leave it to the directors to deal with, they would endeavour to bring it down to that figure.

Mr. Woodward withdrew his amendment, and the adoption of the report was then carried.

The Chairman moved that the following dividends be declared: At the rate of 10 per cent., subject to income tax, on the preference shares, and at the rate of 7 per cent., free of income tax, on the ordinary shares.

Mr. Low seconded, and the motion was carried.

Mr. Woodward, upon the suggestion of Mr. Greenwood, the auditor, submitted the following resolution, which the chairman accepted, "That it be a recommendation to the board to distribute the investments sf the company so as not to have more than £5,000 in any one security."

Mr. Prüst seconded, and the resolution was agreed to.

Mr. Griffiths moved a vote of thanks to the chairman and directors, which was seconded by Mr. Woodward and carried, the meeting thereupon terminating.

The Anglo-American Brush Electric Light Corporation, Limited.

THE report to be presented at the coming annual general meeting is as follows:—

The directors beg to submit to the shareholders the report and statements of accounts for the year ended 31st December, 1884.

The need for a lengthy report upon the proceedings of the corporation during the past year is lessened by the publication in July last of an *ad interim* report, which informed the shareholders of the business and progress effected during the first half of the year, and by the issue of the circular in view of the extraordinary general meeting, on December 22nd, at which the provisional agreements for the absorption of the Great Western Electric Light and Power Company, and the Brush Midland Electric Light and Power Company, were adopted.

The shareholders will have concluded from the half-yearly report already referred to, as well as from the universal depression of trade throughout the country, that the expectations of a revival of business entertained a year ago, have not been realised to the full extent. Nevertheless, the board have the satisfaction of being able to congratulate the shareholders upon the great advance made by the corporation, and upon the decidedly improved position which electric lighting occupies among the industries of the world. The progress made by the corporation in perfecting its apparatus and in extending its business has been very considerable, and, consequently, good progress has been made, as will be seen from the accounts, towards attaining a dividend-paying position.

This advance is in a large measure attributable to the fact that the corporation have extended the scope of their operations by undertaking the work of contractors, and to their having secured important and remunerative contracts from the Government, and other sources, for the installation of the electric light; and the directors are glad to recognise in the cordial manner in which the proposal to amalgamate with two of the subsidiary Brush companies was agreed to, that the shareholders appreciate and support the policy of the board, which renders possible this extension of the sphere of operations.

The concentration of the manufacturing works begun in 1883 by the removal of the incandescence department from Portpool Lane to Victoria Works, proved so marked a success, both directly and indirectly, in the reduction of expenditure, and in the increase of general efficiency which resulted therefrom, that the board determined, after careful consideration, to continue this concentration by arranging that the operations hitherto conducted at the Borough Road premises should be carried on as far as practicable at the Victoria Works. The economical advantages resulting from this concentration of work are not fully reflected in the accounts for the past year, inasmuch as the new arrangement was not completed until quite recently, but the course adopted will, it is hoped, during the current year, contribute materially towards a further appreciable reduction, both in the cost of manufacture and in the standing charges.

The shareholders were informed at the last annual meeting that an understanding had been come to, subsequent to the issue of the report, with the British Electric Light Company, by which the action instituted by that company against the corporation was abandoned, it being admitted that the Brush machine in no way infringed the Gramme patent. A satisfactory settlement was also arrived at with Messrs. Latimer Clark, Muirhead & Co., between whom and the corporation cross actions were pending with regard to disputed accounts; and an arrangement has been made with the Hammond Company by which they have, for a consideration, been released from their contract to re-purchase the apparatus returned by them under the agreement referred to in the last report.

The directors regret the heavy loss sustained by the corporation in connection with the law suit, *re* Muir & Co., reported to the shareholders in July last. The corporation are now, however, happily not involved in any litigation, and the directors trust that the exceptional items of law charges which have hitherto absorbed so large a proportion of the gross profits, will find no place in the future profit and loss accounts of the corporation. The board, however, cannot but regard it as their first duty to take such steps, with a view to the maintenance and protection of the valuable patent rights of the corporation, as may from time to time become necessary, and to exercise due vigilance in detecting and taking proceedings in respect of infringements.

The directors felt it incumbent upon them to take active steps to obtain adequate amendments in the legislation with regard to electric lighting, and early last year the corporation directed the attention of the public to the unprecedented and exceedingly onerous conditions imposed upon electric lighting contractors by the Act of 1882, which is so largely responsible for the delay in the establishment on a large scale of central stations, in the absence of which the supply of electricity for house-to-house lighting cannot be economically undertaken. Later in the year a deputation to the Board of Trade was organised by the chairman, and, as the shareholders are already aware, the interview with the President of that department was of a character to encourage the hope that a fair and reasonable proposal of reform will be favourably received by the Goverment. To judge from the feeling of the public, as expressed by the Press, the country now generally recognises that an important industry is suffering from unduly repressive legislation. Since the time when the deputation waited upon the Board of Trade, a powerful and representative committee has been constituted to formulate, at the request and for the consideration of the Board of Trade, the views of the electric lighting companies, and others interested in the matter, as to the nature of the amendments required. The cause of reform has also been very materially promoted by the independent action of other bodies. A very excellent report upon the subject has been drawn up and submitted to the Board of Trade by a Society of Electrical Engineers; and public opinion may fairly be said to be aroused in the matter, so that it may reasonably be hoped that the injury unintentionally inflicted upon electric lighting by Parliament will speedily be remedied.

The manufacture of the improved Brush armature has been systematically proceeded with, and the results obtained exceed the expectations formed regarding it. By its use the output of the "Brush" dynamo is increased by fully forty per cent., and the efficiency is also very greatly increased. These new armatures are made interchangeable with the old, and no other part in the machine requires alteration. A considerable demand already exists for them, and it may be confidently expected that this demand will increase, and that every machine in use will be ultimately so fitted.

The "ratchet" lamp (Brush-Sellon patent) of which mention was made in last year's report, has also been well introduced and has given complete satisfaction as an almost absolutely steady and unflickering arc lamp. The system of manufacture pursued in the case of this as well as of the "Brush" lamp, is the same as that for the dynamos, namely, to secure an interchangeability of parts. At the same time the "Brush" lamp still holds its own as the most simple, reliable and enduring lamp for arc lighting in exposed situations.

In the "incandescence" department satisfactory progress has been made. The "Victoria" machine has fully maintained its high position as the leading machine for incandescence lighting in the market. Great improvements have been made in its armature with excellent result, and various minor but substantial improvements have also been introduced, without increasing the price, and not only has the cost of production of the machines been materially reduced by the organised system of manufacture, but the "Victoria" as well as the "Brush" dynamos are now made so that the parts of similar machines are interchangeable, thus increasing their relative value, and enabling the corporation to sell at higher prices. Special attention is being given to the manufacture of lamps of high candle-power, and the "Victoria" lamp takes a prominent position amongst the best known incandescence lamps.

In connection with the extension of the business of the corporation as contractors for installation work, it became necessary to work out complete sets of fittings, for ship, factory and private lighting, and the production and sale of these will henceforward form an important part of the business of the corporation.

The capital account has been increased by £7,992, the amount received from holders of partly paid shares in the exercise of the option given them of making their shares fully paid. The maximum number of fully paid shares the corporation are eventually liable to issue to the shareholders in the Great Western and Brush Midland Companies, is stated in the balance-sheet, but the actual amount of capital that will ultimately have to be issued is dependent upon the number of fully paid shares in these companies that will be surrendered.

The total amount owing by the corporation to creditors and on bills payable is £3,726 6s. 4d., and as the good debts due to the corporation amount to £19,560 16s. 8d., and the cash at their credit with the bankers and in hand stands at £10,541 4s. 2d., the satisfactory position of the corporation will be at once realised by the shareholders and the public.

The amount of the provision against shares held by the corporation in subsidiary companies has been reduced from £99,200 to £50,000, the shares of the Brush Midland Electric Light Company, Great Western Electric Light Company and Eastern Electric Light Company, having been eliminated from the contra account, owing to these companies being now in voluntary liquidation.

The patents account shows an increase of £3,676 12s. 11d. upon last year's valuation. This increase represents the cost of maintaining the English and foreign patents, and of the experiments and other initial steps necessary to obtaining patent protection for the several inventions which have been developed in connection with the advance made by the corporation in the various branches of its manufacture, and in introducing the new machines and apparatus. Under the head of appropriation of profits, the directors recommend the reduction of patents account by the amount of £1,500 as a matter of principle, and not because they believe that there is anything either in the present aspect of affairs or in the general progress of electric lighting to call for a depreciation of the value of the patents possessed by the corporation. The events of the year have really tended to increase the intrinsic value of these patent rights, and the board are of opinion that the figure at which this asset stands in the books represents its minimum value.

As a result of the concentration of the manufacturing arrangements, a considerable amount of the plant, fixed and otherwise, at the Borough Road and Portpool Lane premises, has been consigned to stock, and will be further employed or eventually realised as opportunity offers. It has consequently been deemed advisable to have a careful re-valuation and readjustment made of the property and stock accounts, the result being to reduce the property account to £40,147 9s. 6d., and to increase stock account to £69,171 11s. 1d; the latter figure representing the minimum cost value of the stock on hand, stores, and goods in course of manufacture. In view of the extremely low figure at which property stands in the books, and having regard to the increased efficiency resulting from the concentration of the works, it is not thought necessary to make any reduction this year in respect of depreciation.

The amount of £413 7s. 4d. representing premiums on insurance, rent, &c, paid *in advance on account of* 1885, and not therefore chargeable against last year's revenue, has been carried to a suspense account.

The item "assets realisation accounts £29,475" represents the gross value of the assets to be transferred from the Great Western and Brush Midland Companies, in addition to the £4,000 cash which has been already received. The absorption of these companies was not effected in time to enable the various assets to be incorporated in the books of the corporation under their respective heads, but it is estimated that when the liquidation of these companies has been closed, the undermentioned accounts will be increased as follows :—

Property Account.—By the value of plant at lighting stations, installations on hire, freehold and leasehold land and buildings, &c....	£12,700
Stock Account.—By the value of manufactured goods on hand	£4,000
Cash (in addition to the £4,000 already received)...	£6,800
Patents Account.—By balance representing goodwill and surrender of Brush and Lane-Fox licenses for twenty-eight counties in England and Wales	£5,975

In addition to the above-mentioned assets, the corporation as *shareholders*, have received from the Great Western Company £1,000. This amount has been carried to credit of profit and loss account, and will be dealt with in the appropriation of the net balance of profit.

It will be seen from the profit and loss account that the result of the year's operations is a gross profit of £22,948 10s. 3d., including profit on shares in Great Western Company, proceeds of sale of patents and bad debts recovered, less provision for doubtful debts, and that after deducting all standing charges and expenses, there remains a surplus profit on the year's working of £5,743 18s. 6d., notwithstanding the heavy loss attendant upon the Muir lawsuit, and after charging sundry items more properly belonging to the previous year. From this profit, however, has to be deducted the adverse balance of £1,616 3s. 2d. brought forward from last year, leaving, as the available result of all the transactions of the past year, a net surplus profit of £4,127 15s. 4d.

An analysis of this profit and loss account will show not only a very marked improvement in the business effected, both as regards its volume and its profitable character, but also that the efforts of the board to economise in every department have been, in a very high degree, successful. Comparison with the operations of the previous year shows that the gross actual trading profit has increased by nearly £120 per cent., while the standing charges have been reduced by more than 45 per cent.

The directors recommend, that of the amount standing to credit of profit and loss account, £1,000—being the sum received in respect of the shares of the Great Western Company—be applied to reduction of the cost of goodwill and licenses, that £1,500 be applied to the reduction of patents account, as explained in paragraph 16, and that the remainder, amounting to £1,627 15s. 4d., be carried forward to next account.

The directors who retire by rotation are Mr. Gibbs, Mr. Courtenay, and Mr. Ladd, who, being duly qualified, offer themselves for re-election. The directors have pleasure in announcing that Mr. Joseph Bevan Braithwaite, junior, a member of the firm of Messrs. Foster and Braithwaite, and late chairman of the Great Western Electric Light Company, has, at the invitation of the board, expressed his willingness to join the directorate, but as the board are not empowered, under the articles, to appoint an additional director, they nominate Mr. Braithwaite for election by the shareholders.

BALANCE SHEET.—DR.—To capital.—17,697 shares of £5 each fully paid, £88,485; 23,003 shares of £5 each £3 paid, £69,009; 6,695 shares of £5 each fully paid to be issued to shareholders in the Great Western and Brush Midland Electric Light Companies. That being the maximum number to be issued in pursuance of the resolution passed on 22nd December, 1884, £33,475—£190,969; less amount unpaid in respect of 102 shares forfeited, £387—£190,582. To Creditors.—Amount due to sundry creditors, £3,065 4s. 8d.; bills payable, £661 1s. 8d.—£3,726 6s. 4d.; to provision for shares in subsidiary companies, £50,000; to balance of profit and loss account, £5,743 18s. 6d.; less adverse balance brought forward from 1883, £1,616 3s. 2d.—£4,127 15s. 4d.; (liability on bills receivable discounted, £1,735 5s. 3d.). Total, £248,436 1s. 8d. CR.—By patents, £28,676 12s. 11d.; by property, £40,147 9s. 6d.; by stock, £69,171 11s. 1d.; by debtors, £19,560 16s. 8d.; by cash, £10,541 4s. 2d.; by shares and debentures in subsidiary and other companies, £50,450; by suspense account—payments chargeable to 1885, £413 7s. 4d.; by assets realisation accounts—Great Western and Brush Midland Electric Light Companies, including freehold and leasehold lands and buildings, plant, stock, &c., taken over from these companies, £29,475. Total, £248,436 1s. 8d.

APPROPRIATION ACCOUNT.—DR.—To amount written off patents account on account of patents sold and depreciation, £1,500; to amount written off assets realisation account for goodwill and licenses, £1,000; to balance carried to next account, £1,627 15s. 4d. Total, £4,127 15s. 4d. CR.—By net balance of profit and loss account, £4,127 15s. 4.

PROFIT AND LOSS ACCOUNT.—DR.—To general charges, viz.:—Rent, rates and taxes, gas and water, probationary and public installations, and fuel, £4,615 1s. 3d.; directors' fees, auditors' fee, 1884, salaries, law charges, insurance, postages, stationery and printing, travelling, carriage and freight, advertising, agency charges and sundries, £10,078 19s. 6d.; law charges, £1,891 2s. 3d.; rent account, 1883, £303 6s. 1d.; auditors' and accountants' fees, 1883, £212 11s. 10d.; carriage and freight on old contracts, £103 10s. 10d.; balance being net profit for the year, £5,743 18s. 6d. Total, £22,948 10s. 3d. CR.—By gross profit on trading, £16,723 17s. 10d.; by sundry profits, £6,224 12s. 5d. Total, £22,948 10s. 3d.

Anglo-American Telegraph Company, Limited.

THE report of the directors states that the total receipts from the 1st July to the 31st December, 1884, including a balance of £2,503 11s. 5d. brought forward from the last account, amount to £243,066 12s. The traffic receipts show a decrease of £12,136, as compared with the corresponding period of last year. The total expenses of the half-year, including repair of cables, &c., as shown by the revenue account, amount to £52,639 17s. 4d. The directors, under the powers conferred upon them by the articles of association, have, before declaring the nett profits, set apart the sum of £75,000 to the renewal fund, leaving a balance of £115,426 14s. 8d. Interim dividends of 15s. per cent. on the ordinary stock, and 30s. per cent. on the preferred stock, were paid on the 1st November last, absorbing £52,500, leaving a balance of £62,926 14s. 8d., out of which the directors recommend the proprietors to declare final dividends, less income tax, of 17s. 6d. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and 5s. per cent. on the deferred stock, amounting to £61,250, making a total distribution for the year ended the 31st December, 1884, of £3 2s. 6d. per cent. on the ordinary stock, £6 per cent. on the preferred stock, and 5s. per cent. on the deferred stock, leaving a balance of £1,676 14s. 8d. to be carried forward to the next account.

Direct United States Cable Company, Limited.

THE report of the directors of the Direct United States Cable Company, Limited, for the six months ending December 31st is as follows:—“For the half year the revenue, after deducting outpayments, amounted to £68,824 5s. 2d., against £73,472 12s. 7d. (after similar deductions) for the corresponding half year of 1883, being a difference of £4,648 7s. 5d. against the half year under review. The working and other expenses, including interest on debentures and income tax, &c., amounted to £18,607 15s., leaving a balance of £50,216 10s. 2d. as the net profit of the half year, making, with £2,786 8s. 7d. brought forward from the previous half year, a total balance of £53,002 18s. 9d. For the corresponding half year of 1883 the working expenses and other payments amounted to £21,824 4s. 5d. Interim dividends of 1¼ per cent., each for the quarter ending September 30th, 1884, paid November 15th, 1884, and for the quarter ending December 31st, 1884, payable February 16th, 1885, together amounting to £30,355, have been declared. The sum of £5,396 15s. 10d. has been set aside to the reserve fund, which, after being charged with £73,367 14s. 7d. on repayment of the debenture loan, now amounts to £300,000. A balance on the revenue account of £17,251 2s. 11d. has been carried forward. The debenture loan of £100,000 was paid off on the date due, viz., October 15th last.

The Dundee and District Telephone Company, Limited.

FOLLOWING is the report of the directors to the annual general meeting to be held on February 4th:—

The directors have pleasure in submitting to the shareholders the accounts and balance-sheet of the company for the year ending 31st December, 1884.

In terms of a resolution come to at a meeting of the company held on 6th February last, and duly confirmed by a meeting held on 21st February last, the capital of the company has been increased from £5,000 to £10,000. Of the new shares authorised to be issued 372 shares of £5 each have been subscribed for, and on these the sum of £2 5s. has been called up and duly paid.

The number of wires rented at the close of the year was 340, being an increase of 20 on the previous year, which, considering the opposition with which the company has to contend, the directors regard as gratifying.

The net balance of revenue amounts to		£633 13 7
which the directors recommend should be applied as follows:—		
To reserve fund (which will then amount to £800)	£200 0 0	
To payment of a dividend, at the rate of 5 per cent. per annum, free of income tax	252 17 3	
		452 17 3
leaving a balance of		£180 16 4

to be carried forward to next account, subject to such remuneration as may be voted to the directors.

Anglo-American Telegraph Company, Limited.—At a meeting of the board of directors of this company, held on the 23rd inst., it was resolved (after placing £37,500 to the credit of the renewal fund for the quarter ending 31st December, 1884.) to recommend to the proprietors at the next half-yearly general meeting of the company to be held on the 6th February the declaration of the following dividends:—1. A balance dividend of 17s. 6d. per cent. upon the ordinary consolidated stock for the year ending 31st December, 1884. 2. A balance dividend cf 30s. per cent. upon the preferred stock for the year ending 31st December, 1884. 3. A first and final dividend of 5s. per cent. upon the deferred stock for the year ending 31st December, 1884, —all payable on 7th February next. After paying the foregoing dividends there will be a balance of about £1,500 to be carried forward to the next account. The above dividends, together with those already paid, will amount to £3 2s. 6d. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and 5s. per cent. on the deferred stock for the year 1884. The register of transfers will be closed from 23rd January to the 6th February, both days inclusive.

The Brazilian Submarine Telegraph Company, Limited.—This company gives notice that the coupons on the 5 per cent. debentures due on the 31st inst. will be paid on and after that date at the Alliance Bank, Limited, Bartholomew Lane. Coupons must be left three clear days for examination.

The Eastern Telegraph Company, Limited.—This company notifies that the coupons on the 5 per cent. debentures due on February 1st will be paid by Messrs. Glyn, Mills, Currie and Co., 67, Lombard Street, London, E.C. Coupons must be left three clear days for examination.

The Direct United States Cable Company, Limited.—The board has resolved upon the payment of an interim dividend of 5s. per share, being at the rate of 5 per cent. per annum for the quarter ending December 31st, 1884.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending January 23rd were £3,114, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph Engineers and Electricians.

AN ordinary general meeting of this society was held on Thursday, January 22nd. The minutes of the last ordinary general meeting having been read and confirmed, the President for the current year, Mr. C. E. Spagnoletti, read his inaugural address as follows :—

The PRESIDENT commenced by remarking that he represented a particular branch of electrical science, namely, railway telegraphy. It was impossible to say what development in the science of electricity might take place, seeing the rapid progress which had hitherto been made. The present society was an instance of this progress, as but a few years ago the members were but few in number, whereas at present the total force was very large. The society had recently been incorporated, and a certain amount of the subscription money invested in the funds. It was a satisfactory fact that the society was able to award prizes. There was plenty of ground to work over, the results of which might with advantage be communicated to the society. He thought that the students ought to take a more prominent part in the papers and discussions than was the case; this remark also applied to the members themselves, as the discussions were practically continually carried on by the same individuals. All members ought, as far as possible, to speak occasionally, and to do their best generally to support the society. The sphere of work ought, he considered, to be widened, so as to render the meetings more popular than was the case. There was no need for long speeches, as a few remarks often gave useful suggestions and imparted useful information. The advantages of writing a paper were considerable, as doing so involved considerable research and trouble, which was invaluable to the writer himself. An advantage of having a subject thoroughly discussed was the fact that a large number of links were added to the chain, the total result sometimes leading to invention. It was extraordinary how little apparatus was required in order to enable new ideas to be worked out, the works of Faraday and of Prof. Hughes were examples of this. The President then pointed out the advantage which the members had by the possession of their magnificent library, which was continually being increased. During the past year 120 volumes were added. He hoped that every advantage would be taken of the privilege. There was great probability that before long the society would possess a laboratory for the use of its members. This was a question that ought to be soon considered, and it might be hastened if subscriptions were raised for the purpose. The employment of female labour in electrical work was, he thought, a subject which was worthy of consideration: there were many departments in which such labour could be employed. At the present time incandescence lamps were largely manufactured by females. Turning to electric lighting, he considered that the present state of affairs was brought about by the commercial rush which took place at first. Practical electric lighting was first shown at the Paris Exhibition of 1878; we had afterwards the Paris Exhibition of 1881, and then the Crystal Palace, the Aquarium, the Fisheries, and the Healtheries Exhibitions. All these acted as further inducements for speculators to take the subject up financially. The companies started in 1880, and in 1881 spent nearly all their money in showing what it was possible to accomplish. When the Act of 1882 was passed a very great deal of capital had been wasted, and as the effect of the Act was not to stimulate the industry great depression followed. Petitions, with the object of obtaining the repeal or alteration of certain clauses in the Act would shortly be presented, and it was to be hoped that good results would follow. Generally speaking the Act was not altogether unsatisfactory, though the clauses referring to the conditions under which licenses would be granted pressed hard. There was also considerable ambiguity in the wording. The want of a satisfactory meter for measuring the current was much felt, and until one was designed the charge ought to be so much per light. The compulsory clauses in the Act as to purchase ought, he thought, to be abolished. Also the compulsory laying of mains ought not to be insisted on. The advance which the electric light industry was making in America was, he thought, a most hopeful augury for future success in this country. As regards the value of the two systems of light, he considered the incandescence lamps as quite unsuited for out-door purposes; the Holborn Viaduct experiment proved this. For out-door use the employment of tall masts was, he considered, a good arrangement; in the case of the lighting of railway yards it was a great success from many points of view. The application of electric lighting to railway carriages was a most important subject, though the difficulties in the way were numerous; the lighting of trains was a considerable item of expense to the companies. Gas would be a great competitor for the purpose ; it cost only half as much as oil. Electric lighting could not, he thought, be completely satisfactorily carried out without accumulators, but the latter required perfecting. Coming now to "telegraphy," he would state that considerable advances had been made. The lines were better built than formerly, and the management of the systems throughout the United Kingdom being a single one (and that a good one), satisfaction was given. The promised reduction in the price of telegrams would, no doubt, result in greatly increased work. The further use of the pneumatic tubes would be, he thought, very beneficial. 26,000 miles of wire had been added on the railways. The use of "sounders" was growing and was a practical outcome of the "Bell" instrument invented by Sir Charles Bright. In the Colonies the use of the "quadruplex" was extending, and in America the English system of fast speed working was being adopted. This system was in England being greatly improved and, in fact, this country was taking the lead in this respect. Telephony progressed but slowly here from climatic reasons and cheap fares. The recent opening of the line between London and Brighton proved to a great extent the practicability of long distance working. In London there were 50,000 communications a day carried on. The length of wire in use in the kingdom was 9,000 miles, with 7,000 instruments and 20 exchanges. The present rental was rather prohibitive. Those who used the telephone thoroughly appreciated its value. The concessions granted by the Government would probably stimulate the use of the instrument. The Belgian system of charging so much per conversation, if adopted, would be likely to afford good results. The Van Rysselberghe system, by which telephonic communication could be carried on simultaneously with ordinary telegraph working, could only be applied to a limited extent. The transmission of power by electricity had only been practically applied in a very few cases, and the extensive experiments of Marcel Deprez had not led as yet to practical results; the "telpherage" system, however, was making some progress, and the company were now prepared to undertake contracts; one or two lines had been erected and were now working successfully. A telpherage company had been formed in the United States. The carriage of goods, &c., by means of cars worked by accumulators, was likely to be a formidable competitor to telpherage, and it appears to be a simpler method of effecting conveyance. By either system lines of light railway could be worked under conditions where ordinary steam locomotives would be objectionable. The system of railway telegraphs for regulating the traffic was continually undergoing improvement, and the railway authorities now seem fully to recognise the benefits resulting from their use, an encouraging fact to railway telegraph engineers. The use of repeaters for indicating the position of the arms of the distant signals, the condition of the lamps, and also the position of level crossing gates and drawbridges, was now very general. Electrical tell-tales showing whether the water tanks were full or empty were also much used. Telephones were being employed to a considerable extent to enable signalmen to communicate with each other. Electrical locking gear for controlling the movements of outdoor signals and points was being extended with great advantage. A "tablet" system was also being introduced on the principle of the staff method, the tablets being placed in a box and locked so that they could not be removed unless the signalman in advance released them. The utility of the improvements was shown by the following statistics:—In 1873 there were 16,000 miles of railway line opened, and in 1883 the mileage was 18,681. In 1873, 455 million passengers were carried, and 40 people were killed and 1,522 injured. In 1883 the number carried was 683 million, of which 14 only were killed and 584 injured. In 1873, 190 millions of tons of goods were carried, and in 1883 the amount was 266 million. The train mileages in the years named were 197 million and 267 million respectively.

The usual vote of thanks having been proposed, seconded and carried, the meeting adjourned.

Physical Society.—January 24th.

Prof. GUTHRIE, President, in the Chair.

Messrs. J. Rose Innes, A. Howard, and A. M. Worthington, were elected members of the society.

Some "Lecture experiments on spectrum analysis" were shown by Mr. E. CLEMENSHAW. The chief point in these experiments was the production of a brilliant light without the use of the electric arc. A small quantity of a solution of the salt to be experimented on is put into a flask in which hydrogen is being evolved by the action of zinc upon dilute sulphuric or hydrochloric acid; the bottle is provided with three necks, one being fitted with an acid funnel, one with a jet, and by the other is introduced a current of coal gas, or, better, of hydrogen, by which the size of the flame can be increased and regulated. The jet, which is about one eighth of an inch diameter, is surrounded by a larger tube, by which oxygen is admitted to the flame, the result being a brilliant light, giving the spectrum of the substance, which is carried over mechanically by evolved hydrogen. The spectra of sodium, lithium, and strontium, were shown upon the screen, and the absorption of the sodium light by a Bunsen flame containing sodium was clearly seen.

An instrument to illustrate the conditions of equilibrium of three forces acting at a point was exhibited by Mr. WALTER BAILY. This instrument consists of a circular disc of soft wood, from the back of which an axle projects. The disc is provided with a graduated circle, and its centre marked by the intersection of two fine lines upon a small mirror. Three compound threads, each consisting of two threads connected by a short piece of elastic, are knotted together, the free end of each being fastened to a pin. Two of these pins are stuck into the disc at such a distance from the centre that the knotted ends cannot reach the centre without stretching each thread, and the remaining pin is then adjusted so that this condition is fulfilled. There are now three forces in equilibrium acting at the knot. The angles between their directions are obtained from the readings of the graduated circle, where it is crossed by the threads. To determine the magnitude of these forces, the axle of the disc is held horizontally and turned till a thread is vertical, the pin is then removed, a scale-pan attached to the end of the thread, and weights added till the knot is brought back to the centre. This is repeated with the other threads. It was found possible to show the proportionality of the forces to the lines of the opposite angles, with an error not exceeding one per cent.

Mr. C. H. HINTON read a paper on the "Poiograph." As the result of a process of metaphysical reasoning, Mr. Hinton has come to the conclusion that relations holding about "number" should be extended to space. Starting from the premesis that the relation of a number to a number is a number; *e.g.*, the "relation" of 6 to 2 is 3, the author proceeds to carry these principles into the considerations of space, and concludes that when properly understood the relation of a shape to a shape is a shape, and that of a space to a space is a space. The shape that shows the relation of a shape to a shape is called a "poiograph." To form a poiograph the content of each shape is neglected, and the shape is represented by a point, each point being by its co-ordinates representative of the properties of the shape considered. The resultant shape is a "poiograph."

NEW PATENTS—1885.

889. "Producing rapid motion of rotation by hydraulic machines for driving dynamo-electric machines." E. CIOTTI. Dated January 21.

890. "Electro-telephonic receivers." A. A. CAMPBELL-SWINTON. Dated January 21.

917. "Fixing and insulating supports for electric wires." B. PITT. Dated January 22.

992. "Electrical motors." R. A. LEE, J. E. CHASTER. Dated January 23.

1014. "Method of manufacturing stencil plates for graining, &c., and other perforated or openwork metallic goods by electro-metallurgy." J. J. CALLOW. Dated January 23.

1037. "Switch-boards or apparatus for connecting circuits and signalling in telephone exchange systems." T. J. HANDFORD. (Communicated by C. Lemon.) Dated January 24. (*Complete.*)

1053. "Application of electricity for keeping steam boilers free from incrustation." W. R. LAKE. (Communicated by A. E. E. Jeannolle.) Dated January 24.

1088. "Galvanic or primary batteries." C. MALTBY-NEWTON. Dated January 26.

1101. "Telephonic and telegraphic apparatus." J. STEPHEN. Dated January 26.

1156. "Telephonic systems and instruments to be used therein." P. M. JUSTICE. (Communicated by T. Wallace.) Dated January 27.

1164. "Electrolytical process for obtaining, separating, and cleansing certain metals and alloys, and removing coatings thereof from other metals." P. JENSEN. (Communicated by O. Kersten.) Dated January 27.

1184. "Regulation of electrical circuits and appliances connected therewith." D. S. SALOMONS. Dated January 27.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

262. "Improvements in dynamo-electric machines." W. M. MORDEY. Dated January 1. 6d. Has for its object the construction of an improved form of dynamo-electric machine (generator or motor) of the drum armature type, and has reference to making the drum or cylinder of an undulated, corrugated, sinuous, or wavy form externally; the undulations or alternate depressions and projections being in the direction of its length. Fig. 1 is an end elevation of a machine constructed according to this invention. Fig. 2 is a longitudinal section through the armature and pole pieces of the same. In building an armature according to this invention, one plan shown in fig. 2 is to place on the shaft or axle, first a certain number of thin iron plates or washers, *a*, all of one diameter, slightly separated from each other by strips of paper, or other insulating material, placed radially between the plates, and then in the same way a number of similar plates or washers, *b*, of larger diameter. These are followed by more washers of the smaller size, *a*, and so on until the required length is obtained, when the plates are firmly clamped by nuts and washers at the ends. Sometimes pegs of wood or other suitable substance are used, to give increased stability to the wider sets of plates. Air passages, *c*, for cooling purposes are formed by holes cut in the plates before they are placed together as above described. In placing the conductor upon the armature the inventor leaves an opening from the external air to the ends of the air passages, *c*. The air which enters these passages passes radially between the plates through the spaces between the strips of insulating material employed to separate them, and out between the conducting strips or bars.

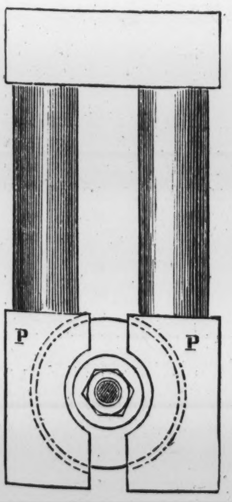


FIG. 1.

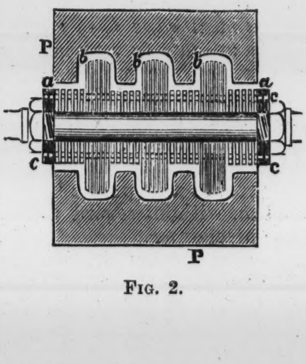


FIG. 2.

1065. "Improvements in regulators for dynamo or magneto-electric machines or generators." H. J. HADDAN. (Communicated from abroad by the Bain Electric Company, of America). Dated January 9. 6d. The invention consists in a regulator wherein the brushes are automatically adjusted, and this automatic adjustment is the resultant of two forces, the first or prime force which performs the greater portion to the work being mechanical, as that which drives the machine or rotates the armature; and the secondary force which performs the minor portion of the work, being electrical, as the current in the external circuit, or a branch therefrom. This resultant action is so dependent upon the two forces that produce it, that variations in either will cause the regulator to operate properly to maintain the desired condition in the current utilised. Thus if the speed of the armature, or field magnets, as the case may be, varies on account of the variations in the primary force driving it, this variation will automatically modify the resultant action that controls the regulator, in proportion to the variations of speed, and if changes occur in the current in the external or working circuit, these changes will automatically modify the resultant action that controls the regulator in accordance with the changes of the current.

1278. "Improvements in electrical batteries." F. M. LYTE. Dated January 11. 6d. At the bottom of a glass jar is placed a box of sheet lead or antimonial lead about 1 inch in depth and containing peroxide of lead and forming the negative element. To this box is attached a thick wire of lead, or covered with lead insulated from the positive element by means of an India rubber or gutta percha tubing and extending from the box (to the exterior of which it is fastened) nearly to the top of the jar. The positive element consists of a thick zinc wire coiled in the form of a flat spiral. The positive element passes up through a cover with which the jar is provided, being enveloped where it passes through the cover with a short length of India rubber tubing for insulation and provided with a terminal above the cover. A wire from the negative element also passes through a hole in the cover and forms the other terminal.

1790. "Improvements in electric arc lamps." M. H. HURRELL. Dated January 19. 6d. The inventor employs a solenoid or magnet to act directly by a clutch or pawl, or other mechanism, either upon the carbon holder itself or upon the spindle of the pinion, or upon a wheel on this spindle, so as to lift the carbon holder, and by the same movement he brings escapement mechanism into gear with the teeth of the escapement wheel to subsequently control the downward movement of the carbon holder.

2006. "Improvements in dynamo-electric machines." W. A. CARLYLE. Dated January 24. 6d. The chief object of the invention is to provide means whereby the hollow cylindrical armature of such machines when revolving shall cause continuous currents of air to flow through itself and other parts of the machine.

2674. "Improvements in insulating wires for use as electric conductors." W. E. HEYS. Dated February 4. 2d. The inventor takes wires that have been covered in the ordinary manner with paper, cotton, silk, or other fibrous or suitable material. If the covering is of paper, cotton, or other substance consisting mainly of cellulose, he passes the covered wire through cuprammonium, and thereafter drys it by natural or artificial means. If the covering material contains no cellulose, or only a small quantity, he passes the covered wire through a solution of cellulose in cuprammonium, and drys it thereafter by natural or artificial means.

2722. "Improvements in apparatus for enveloping insulated conductors with lead or alloy, partly applicable in the making of lead pipes." J. J. HARROP. Dated February 5. 6d. Relates to the covering with lead of the insulated wires or conductors used ln telegraphic or telephonic communication, and in the conveyance of electric or galvanic currents. In a former invention for which Letters Patent, No. 485, of the year 1874, have been granted, the inventor passed a telegraph cable through a long hollow core or cores which was drawn upward through a fixed lead container, so as to keep the end of the core at an uniform distance from the die. Owing to the length and weakness of the said core, and to other causes, the arrangement was not well adapted for the production of a thin covering, and for the covering of small conductors. In the present invention the inventor employs a moving container carried by the press ram, and he passes the conductor over a pulley iuto a hollow neck, which connects the container with the ram, or which is formed by an extension of the ram. The conductor passes upward through a central tube to a short core, which is connected by means of two, three, or more arms with the die, or with a part in which the die is fixed, so that the core is retained in a position which is concentric with the die.

2820. "Improvements in telephone receivers." G. H. BASSANO, A. E. SLATER, and F. T. HOLLINS. Dated February 6. 6d. Under this patent the inventors prefer to dispense with the form of spring and armature or armatures described in Letters Patent No. 1,290, of March 10th, 1883, and to use the mere torsion or twist of a piece of wire or strip of metal to keep the vibrating disc or plate in a state of tension. Fig. 1 is a plan of a double armature or armatures kept in a state of tension by a piece of wire (preferably steel) attached to each of the two armatures—*a* is a metallic rim having an outer ridge or collar (shown in section at *a* fig. 3), having four ears or projections, *b*, *b*, *b*, *b* (also shown in section at *b*, fig. 3), between which rest the soft iron or steel armatures, C, C, held upon centres, *f*, *f*, *f*, *f*. *d* (fig. 1) is a short piece of wire (preferably steel), which, with the pin, *e* (seen in section fig. 2), forms a ┬ piece. The ends of the wire, *d*, which are squared, pass through holes in the armatures, C, C, and are riveted, soldered, or otherwise secured, just at the ends of the wire, *d*, so that the greater part of the wire, even where passing through the armatures, is free to twist, whilst the wire is rigidly secured to both armatures. The pin, *e*, which has a screw thread is fitted with a washer, *h*, and nut, *i* (fig. 2), between which is placed a disc or plate of non-inductive material, such as pine, ebonite, mica horn or ivory, and sufficiently thick as not to act as a flexible tympan—see K, fig. 3. Now when the magnet, M, having a coil of insulated wire, A, A, on each pole is brought near the armatures, C, C, the armatures are pulled or attracted out of their normal position, and being centred at opposite points, each of the armatures twist the wire, *d*, in opposite directions; and when the magnet is withdrawn, or the polarity of the magnet altered or reversed by a current of electricity passing through the coils, A, A, the armatures, C, C, are released, and, by the untwisting of the wire, *d*, fly sharply back into their normal position. As the pin, *e*, attached to the centre of the wire, *d*, carries the disc, K (fig. 3), every time the armatures, C, C, are attracted or pulled out of their normal position, a rarefaction of the air takes place in the recess or cylinder formed by the cap or lid, N, of the case, O (fig. 3), and when released the disc, K, moving sharply back to its normal position, causes a condensation of the air; therefore a varying current of electricity passing through the coils, A, A, causes, through the movement of the disc, K, varying condensations and rarefactions of the air in the cylinder or recess described.

FIG. 1

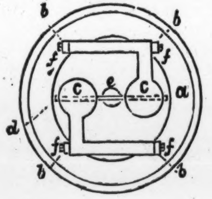


FIG. 2.

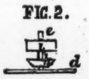
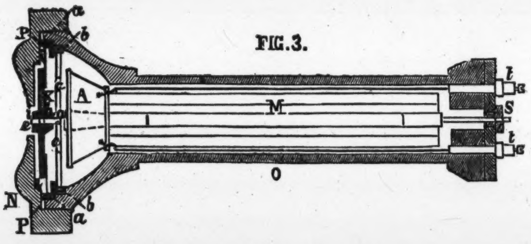


FIG. 3.



CORRESPONDENCE.

Railway Signalling.

In the leading article of your issue for the 17th inst. we noticed a remark to which we should like to call your attention. Referring to a recent railway accident you say "the junction points failing to work in correspondence with their lever owing to disconnection in the connecting rod is, we believe, a case almost unheard of; the necessity for indicating their actual position by means of electrical repeaters has therefore not occurred."

Whilst quite agreeing with you that the accident mentioned was a most unusual one, permit us to point out that not only has the electrical repeater been thought of in this connection, but it is already in regular use on the London and North Western Railway in Fletcher's interlocking apparatus, of which we are the makers. This apparatus not only renders it impossible for the signalman to lower his main line signal to "line clear" while the siding points are open and "*vice versa*," but also indicates whether the points are actually open or closed by an electrical repeater in the signal cabin.

Blakey, Emmott & Co.

Northern Telegraph Works,
Halifax.

The Membrane Diaphragm not Goldbeaters' Skin.

It seems to me not a little surprising that none of your critical correspondents touching the Bell patent has made any comment on the introduction of four words in the disclaimer, which are not to be found in the original patent, and which clearly may mislead the public. I refer to the words "*like gold beaters' skin*" following the word "membrane" in the disclaiming clause in the fourth plan.

In the original patent the word "membrane," without the qualification "*like goldbeaters' skin*," is used eight times in the description of the instrument which was used as a transmitter and receiver as stated in the fifth paragraph of the fourth plan.

It may be said this is a small matter. To this suggestion I reply in the words used by Mr. Justice Fry in his judgment in the U. T. Co. *v.* Harrison-Cox-Walker. "Small diversities in delicate matters often make the whole difference between success and failure." I was led to examine into this by the remark made to me by an eminent barrister (who was engaged in the case before Mr. Justice Fry), that a diaphragm of parchment could not be used, because the words of the disclaimer were, "*a membrane like goldbeaters' skin*," and parchment paper, very thin fibrous wood, were not like "goldbeaters' skin."

After a careful examination of the original patent I failed to find the words "goldbeaters' skin" in any part of it, and it is evident that these words did not accidentally fall into the disclaimer; they must have been inserted with an intention, and any person possessed of ordinary understanding can see that they may mislead the public.

The patentee found it necessary to file a disclaimer in order to save the patent, which was void in consequence of the publication of the membrane plate with a steel spring armature attached to it, on July 3rd, 1876, in England.

In that disclaimer the words "*like goldbeaters' skin*" were interpolated so as to lead the public to believe that the membrane disclaimed was "like goldbeaters' skin," and that no other membrane, such as parchment, paper, or thin wood could be used.

It is very ingeniously stated in the disclaimer that "*such a membrane is of small utility*." This appears to be an attempt (a very lame one) to throw dust into the eyes of the public, and to lead it to believe that the goldbeaters' skin membrane is the only kind of membrane disclaimed, and that such a membrane was of little utility.

The use of a membrane carrying an armature was made free to the public by the publications above referred to, without regard to the patent or to the words of the disclaimer.

The signification of the word "membrane" has a very wide range—and includes a great variety of substances—such as skins of all animals, paper, thin fibrous wood, all fabrics woven with threads, and other substances.

Query—Does the interpolation of these words affect the validity of the patent?

Das Telephon.

January 26th, 1885.

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MEASURING INSTRUMENTS.—Cardew's Universal Voltmeter, Paterson's Patent Electro-magnet Am and Voltmeters, and Engine-room Ammeters; Ayrton & Perry's Am and Voltmeters, Ohmmeters, Powermeters, Tachometers, &c.

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